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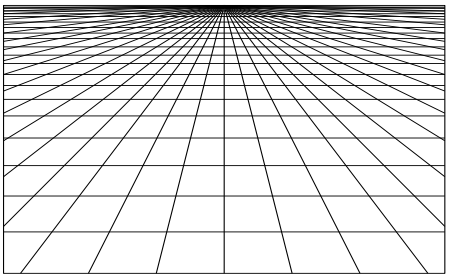

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National System of Innovation, Triple Helix and Intermediary Innovation Support Organisations in a Post-socialist Country: the Case of Latvia

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ABSTRACT

In the formation of a knowledge-based economy an increasing attention is being paid to the fact that national competitiveness largely depends on the efficient linking of different actors within a national system of innovation. Among others, one of the crucial links in seen between university and industry in promoting innovation process. One of widely applied policy options for stimulating their interaction and knowledge transfer between them is through the promotion of intermediary innovation support organizations. This is a topical and disputable issue not only in developed countries, but also transitional economies as in the case of post-socialist countries like Latvia. However, issues related to the promotion of innovative development are context specific for these economies, thus direct application of western models to post-soviet conditions is problematic, since different and specific sets of problems have to be faced. This thesis examines the related theoretical approaches and concepts both on demand and supply side developed in the western world, and implications, when these are applied to other contexts. It aims not only to relate them to post-socialist countries, but also to promote dialogue between different western schools of thought themselves. Furthermore, this study aims to detect and analyse the developments of intermediary innovation support organisations in Latvia and their efficiency as well as the drawbacks in fulfilling tasks ascribed to them. The roles of Triple Helix elements, i.e., higher education and research organisations, industry and government, are examined in the formation and performance of these support organisations. Like in other European countries, there is a certain mismatch between the words and the deeds, though due to specific circumstances. On a meso level, the Triple Helix roles have not been fully comprehended and adopted yet by the involved actors. From a macro perspective, a well-functioning national system of innovation is still under formation. Alongside the need for a more profound governmental ideological and financial support and venturesome people, there is also a need for the change of governing mentality, as well as a further elaboration and optimisation of organisational and institutional structure.

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Abbreviations

BIC	Business Innovation Centre
CEECs	Central and Eastern European countries
EU	European Union
IASP	International Association of Science Parks
ICECE	Innovation Centres in Eastern and Central Europe
IISO	Intermediary innovation support organisation
IRC	Innovation Relay Centre
LAS	Latvian Academy of Sciences
LTC	Latvian Technological Centre
LTICA	Latvian Association of Technological Parks, Centres and Business Incubators
LTP	Latvian Technology Park
LVL	Local currency in Latvia
NSI	National System of Innovation
NTBFs	New technology based firms
RTU	Riga Technical University
R&D	Research and development
SI	Systems of innovation
SMEs	Small and medium-sized enterprises
S&T	Science and technology
S&TS	Science and technology system
TH	Triple Helix
TP/C	Technology Park/Centre
TT	Technology transfer
USSR	Union of Soviet Socialist Republics

1. INTRODUCTION

1.1 Research area

During the last decades there has been an increasing understanding both in developed and developing countries of the changing factors in influencing national competitiveness under conditions of international globalisation. In both academic and policy discussions, innovation-related issues have become matters of central interest to many of the actors involved, due to recognition of the crucial impact of innovations on national competitiveness and the national economy as a whole. Development, production and application of new products and processes through the commercialisation of scientific results form the basis of the new knowledge-based or learning economy. These processes have, to a smaller or larger extent, become imperatives of economic development for the current generation.

The shift to this new perspective has also dictated a need for appropriate theories, concepts, and analytical tools for exploring, understanding, and analysing these ongoing processes in terms of their economic, political and social aspects. It has become vitally important to understand their underlying principles, interconnections, consequences, and future prospects. Since the beginning of Schumpeterian era in 1930s, which can be considered as the starting point for theory and research aimed at understanding the role of innovation in the economic development, there have been ever increasing attempts to map the patterns and dynamics of innovation.

Boundary breaking and blurring, in both geographical and institutional terms, is one of the most characteristic traits of the new economy. Science, research, technology, and their combinations, in both a literal and a figurative sense, are the keywords for this era. The shift to a knowledge-based economy has introduced new actors, as well as assigning new roles to already exiting ones.

Linkages among actors involved in innovation processes are coming to be considered as vitally important. Of these, one of the crucial links is that between higher education and research organisations, on the one hand, and industry, on the other. In promoting innovation processes, this linkage is frequently mediated by governmental initiatives. Such interactions are increasingly coming to be viewed in a wider context - i.e., network of innovation-related actors on local, sectoral, regional, national or international level. This perspective has led to the comparatively recent development of systemic approaches to the analyses of innovation processes.

These practical and theoretical aspects of innovation are topical issues, not only in the developed countries but also in transitional economies such as the post-socialist countries. In post-socialist economies different and specific problems have to be faced, since they have recently experienced a shift from planned to market economy, as well as a consequent shift in the direction of the knowledge-based economy.

1.2 Research aim

The purpose of the current study is to investigate and analyse the development of innovation-related linkages among academia, industry, and government from a systemic perspective. Empirically, the study focuses on intermediary innovation support organisations (IISOs) such as technology parks/centres (TP/C) in a post-soviet country (Latvia). These organisations are being developed in order to fill the gap between higher education and research organisations and industry. Of key importance to the study is their efficiency, as well as the drawbacks of these IISOs in fulfilling the assigned tasks to them - especially with reference to the promotion of technology transfer between the academic and industrial actors. These issues are seen as highly

relevant, since TP/Cs are a relatively new phenomenon in this region, and have not yet been widely or intensively researched.

1.3 Level of analysis

Within the broader field of innovation studies it is possible to distinguish between three levels of analyses - micro, meso and macro - where the first concentrates on the internal capabilities of firms, the second focuses on interactions between and within subsystems, and the third takes a more general view of the whole system.[1] In this study, the focus will be on the meso level – referring, among other things, to the interactions between the firms and universities, which are of prime interest. However, it is rather obvious that although the focus will be mainly on the meso level, elements from the other two - macro and micro - levels will inevitably be touched upon, as no strict demarcation between the three can be made.

1.4 Research questions

In order to be more specific about the issues of interest within this study a set of research questions have been developed. These questions aim at making specific inquiries about the relationships among different concepts, variables, phenomena, events, and things[2] within the chosen research area and the set level of analysis. If, following Flick, we divide research questions into those 'oriented towards describing states' and those 'describing processes', then the current research is more concerned with the latter type, which seek to "describe how

[1] Fischer, M. M. (2001) "Innovation, knowledge creation and systems of innovation*". The Annals of Regional Science* 35, p. 213.
[2] Madsen, D. (1983) Preparing the research proposal (Chapter 4). In *Successful dissertations and theses - a guide to graduate students' research from proposal to completion*. San Francisco/London: Jossey-Bass. p. 37.

something develops or changes".[3] But it must be noted that, far from being only exploratory and descriptive, this study also aims to be of an explanatory character.

1.4.1 General research questions

In formulating research questions it is considered practical to make a distinction between 'general and specific research questions'[4], or 'research questions and subsidiary questions'[5], where the former are formed to guide the overall thinking within the project, while the latter are more concrete and directly related to the empirical procedures.[6] In regard to the general research questions of this study, it has been found useful to make a further distinction between theoretical and empirical ones. Thus, the main research questions are stated as follows:

- *Theoretical 1*: To what extent can the Systems of Innovation (SI) perspective be combined with the Triple Helix (TH) approach to innovation studies in relation to TP/Cs?
- *Theoretical 2*: How can the selected theoretical approaches and concepts be applied to post-soviet countries?
- *Empirical 1*: What are the main postulated and actual operational principles of TP/Cs in Latvia under the given institutional and organisational set-up?
- *Empirical 2*: What are the main differences among firms located in different TP/Cs and these organisations per se (i.e., among organisations within the category of TP/Cs)?

[3] Flick, U. (1998) *An Introduction to Qualitative Research*. London: SAGE Publications. p. 51.
[4] Punch, K. F. (1998) *Introduction to Social Research: Quantitative and Qualitative Approaches*. London: SAGE Publications.
[5] Madsen, D. (1983), op cit.

1.4.2 Specific research questions

As can be inferred from the general empirical research questions, the independent variable here is defined as 'institutional and organisational set-up', while the dependent variable is 'operation of TP/Cs'. Of course, the existence of other potential intervening or intermediary variables affecting their operation must be acknowledged. Thus, no argument is made for any exclusive links between the two main variables. Nevertheless, the study attempts, to the extent possible, to arrive at sound conclusions as potential bases for further studies in this area. The specific research questions derived from the empirical general research questions are accordingly as follows:

- Under what circumstances were the selected TP/Cs established?
- What are the roles of government/academia/industry in TP/Cs' operation?
- What are the contributing factors for successful TP/Cs operation?
- What are the main technology transfer mechanisms used by TP/C firms?

2. THEORETICAL FRAMEWORK

As can be inferred from the general theoretical research questions, the theoretical framework is built upon theories in the field of innovation studies with particular focus on two theoretical approaches - 'National Systems of Innovation' (NSI) and 'Triple Helix' (TH). Other key concepts include those of 'technology transfer' (TT), 'intermediary innovation support organisations' (IISOs), and 'innovation in post-socialist (CEE) countries'. As indicated above, the mutual interrelation and compatibility of the two approaches, their positioning within a broader theoretical discussion, as well as relation to the specified key concepts is examined. This task constitutes a part of the thesis that is equally important as its empirical investigation. The initial assumption is that application of these selected concepts forms a multistage model or

[6] Punch, K. F. (1998), op cit, p. 34.

pyramid, with an increasingly focused subject gradually achieved with every next concept in the following ascending order – NSI-TH-TT-IISO (*see Figure 1*).

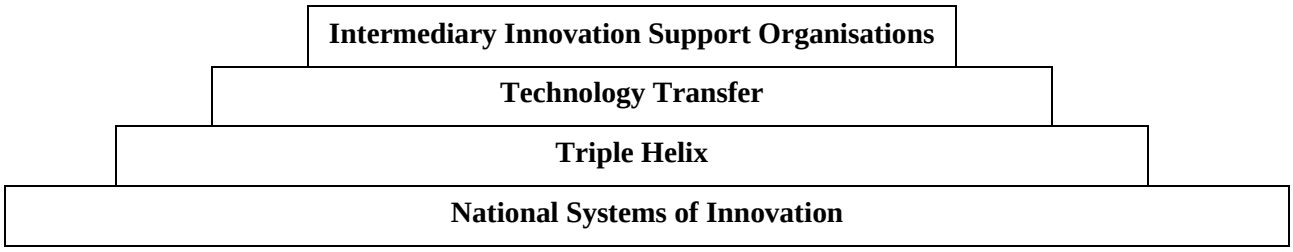

Figure 1. *Hypothetical conceptual pyramid*

To avoid some misunderstanding it should be noted that this hypothetical model does not imply that the given theories and concepts are embedded in a hierarchical way but rather they are closely interconnected in a particular way in the given research area.

2.1 Systems of Innovation approach

2.1.1 Origins

During the post-war period there have been major changes in the conceptualisation of the process of innovation emerging from and leading to different perspectives on this phenomenon. In this regard Roberts has identified four main schools of thought in this field, arranged in the following order of their emergence: (1) linear models, (2) interactive stages, (3) firm-centred models, and (4) systems of innovation theory.[7] In this context, SI theorising developed in a way as a counter approach to the mainstream economics during the last couple of decades. It also embodies the above-mentioned conceptual shift from the so-called linear model (either technology-push or market-pull), which "conceives of commercial research and development (R&D) as applied

[7] Roberts, R. (1998) "Managing innovation: The pursuit of competitive advantage and the design of innovation intense environments". *Research Policy* 27, p. 162.

science and envisions a smooth, uni-directional flow from basic scientific research to commercial applications"[8], to more interactive models of the innovation process, recognising its multidimensional nature as well as the existence of numerous feedback loops among the steps in product development and sources of knowledge outside the firm.[9] Both the systemic and interactive approaches to comprehending and analysing the innovation process argue in favour of the existence of complex interdependencies and interactions between the various elements of the innovation process and the influencing factors.[10]

The SI approaches are considered to have originated from the theories of interactive learning as well as evolutionary and institutional theories.[11] In brief, the interactive learning approach implies the existence of complex interactions among different actors. Thus, the innovation process is assumed to involve interactions between firms, between firms and other organisations, and between organisations and existing institutions (in the form or rules and norms) that both restrict and enhance innovative activity. In its turn, the evolutionary perspective on innovation stresses the existence of mechanisms for both creating and promoting innovations, as well as performing selection both before and after their emergence. SI approaches put considerable emphasis on the institutions, or the so-called institutional set-up, and include both non-profit and profit-oriented organisations by examining their mutual interactions within the defined unit of analysis. In respect to the latter, it should be noted that originally the concept of SI first evolved

[8] Edquist, C., Hommen, L. (1999) "Systems of innovation: theory and policy for the demand side". *Technology In Society* 21, p. 64.
[9] Kline, S.J., Rosenberg, N. (1986) An Overview of Innovation. In *The Positive Sum Strategy: Harnessing Technology for Economic Growth*. Landau, R., Rosenberg, N. (eds.) Washington D.C.: National Academy Press. Pp. 275-305.
[10] Edquist, C. (1997) Systems of Innovation Approaches - Their Emergence and Characteristics. In *Systems of Innovation: Technologies, Institutions and Organisations*. Edquist, C. (ed.), London: Pinter, p. 2; Edquist, C., Hommen, L. (1999), op cit, p. 64-65
[11] Edquist, C. (1997), op cit, p. 5-7; Edquist, C., Hommen, L. (1999), op cit, pp. 67-69.

in a national context and thus initially emerged as 'National Systems of innovation' (NSI) approaches, which were only later supplemented by sectoral[12], regional[13] and technological[14] SI perspectives.

2.1.2 National systems of innovation

The foundations of the NSI approaches can be traced back to the work of Lundvall, Freeman, and Nelson. Some initial ideas underlying this theoretical framework are ascribed already to Friedrich List and his concept of 'national system of political economy'. However, the current NSI concept has developed rather independently of List's ideas, which were later recognised only in retrospect.[15] The national perspective within the SI tradition can be grounded in the common assumption that competitiveness and economic growth are national goals of first priority and that innovations are a key factor in reaching these goals.[16] Furthermore, as it is acknowledged that nations differ in their ability to innovate, different national patterns of innovation are assumed to exist that might be attributed to the existence of different NSIs.[17] This can thus be seen as the basic reason for the interest and analysis of the constituting elements of these NSIs. While among other elements List put great emphases on the role of the state in co-ordinating and carrying

[12] Breschi, S., Malebra, F. (2000) "Sectoral Innovation Systems: Technological Regimes, Schumpeterian Dynamics, and Spatial Boundaries. In *Systems of innovation: growth, competitiveness and employment* Edquist, C., McKelvey, M. (eds.) Vol. 1. Edward Elgar Publishing. Pp. 261-287.
[13] DelaMothe, J., Paquet, G. (eds.) (1998) *Local and Regional Systems of Innovation*. Amsterdam: Kluwer Academics Publishers; Cooke, P., Boekholt, P., Tödtling, F. (2000) *The governance of innovation in Europe.* London: Pinter; Fischer, M. M. (2001), op cit.
[14] Carlsson, B., Stankiewicz, R. (1991) "On nature, function and composition of technological systems". *Journal of Evolutionary Economics* 1 (2), pp. 93-118.
[15] Freeman, C. (1995) "The 'National System of Innovation' in historical perspective". *Cambridge Journal of Economics* 19, p. 5; Lundvall, B.-Å., Johnson, B., Andersen, E.S., Dalum, B. (2002) "National systems of production, innovation and competence building". *Research Policy* 31, p. 215.
[16] Reger, G., Schmoch, U. (eds.) (1996) *Organisation of Science and Technology at the Watershed: The Academic and Industrial Perspective*. Physia Verlag Heidelberg. p. 121.
[17] Ibid.

through long-term policies for industry and the economy[18], Freeman emphasises social and political institutions that accompany technical innovations[19]. For his part, Lundvall accentuates user-producer interaction within the national economy and the concept of learning as the underlying principle of NSI. Among others, he sees the interactions between the firms and higher education and research organisations as an integral part of any model of NSI.[20] Finally, Nelson sees competing and co-operating firms as the basic elements of NSIs, while also acknowledging the role played by national universities as well as public funds.[21] Generally, it is accepted that all elements of NSIs are closely intertwined and a radical intervention at one point can cause unforeseen effects in other areas.[22]

2.1.3 Definitions

Although it can be observed that the concept of NSI is a very broad one, several attempts at defining it have been made. Of course, it is not possible to review all of them, but at least some examples can provide a basic understanding about the state of art and problems in defining the constituting elements of NSI (*see Table 1*).

All the enlisted definitions highlight one or another aspect of NSI, depending on the coverage of the concept either in more general or more concrete terms. However, the following basic elements are in common to them: (a) national framework, (b) public and private actors (firms,

[18] Freeman, C. (1995), op cit, p. 7.
[19] Niosi, J., Saviotti, P., Bellon, B., Crow, M. (1993) "National systems of innovation: in search of a workable concept". *Technology in Society* 15 (2), p. 208.
[20] Lundvall, B.-Å. (1988), op cit, p. 363, 364.
[21] Nelson, R. R. (1998) Preface to part V (National systems of innovation). In *Technical Change and Economic Theory*. Dosi, G., Freeman, C., Nelson, R., Silveberg, G., Soete, L. (eds.), Pinter Publishers, p. 309.
[22] Reger, G., Schmoch, U. (1996), op cit, p. 130.

higher education and research organisations, government), (c) networking and interactions between the involved elements, and (d) knowledge communication.

Table 1. *Selected NSI definitions*

Freeman	The NSI is a network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies.[23]
Lundvall	The NSI encompasses elements and relationships, either located within or rooted inside the borders of a nation state, which interact in the diffusion and use of new, and economically useful, knowledge.[24] In a *narrow* sense the NSI includes organisations and institutions involved in searching and exploring – such as R&D departments, technological institutes and universities, while in a *broader* sense it includes all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring – the production system, the marketing system and system of finance present themselves as sub-systems in which learning takes place.[25]
Niosi et al.	The NSI is the system of interacting private and public firms (either large or small), universities, and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social, and financial, inasmuch as the goal of the interaction is the development, protection, or regulation of new science and technology.[26]
Patel and Pavitt	The NSI is composed of the national institutions ((1) business firms, (2) universities and similar institutions providing basic research and related activities, (3) a mixture of public and private institutions providing general, education and vocational training, and (4) governments) their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change-generating activities) in a country.[27]

Thus, based on these common elements, a provisionally comprehensive definition of NSI could encompass *the totality of public and private organisations interactively operating in the generation, application, commercialisation and diffusion of knowledge forming the base of new or improved technology under the framework of existing institutional set-up within a particular*

[23] Freeman, C. (1987) as cited in McKelvey, M. (1991) *How Do National Systems of Innovation Differ?* Working Paper No 79, LIUTEMA/T/WP-91/0079, p. 11.
[24] Lundvall, B.-Å. (1992) Introduction. In *National systems of innovation: Towards a theory of innovation and interactive learning*. Lundvall, B.-Å. (ed.), London: Pinter, p. 2.
[25] Ibid, p. 12.
[26] Niosi *et al* (1993), op cit, p. 212.
[27] Patel, P., Pavitt, K. (1994) "National innovation systems: why they are important, and how they might be measured and compared". *Economics of Innovation and New Technology* 3, p. 79, 80.

country. Most likely, a more detailed definition is hardly possible, due to the very basic idea of NSI, which stresses the existing differences and divergences between different countries in respect to innovation processes. Rather, only a general definition, indicating the broad common features or giving hints to the elements that should be looked for, can be put forward. The alternative of providing an exhaustive definition is not viable, as it can in no way define everything that should be seen as relevant.

2.1.4 Justifying national perspective

One increasingly topical issue in regard to NSI concerns the adequacy of the national level in the emerging global economy that is now widely postulated. Many authors address the challenges posed by globalisation, internationalisation, and the spread of transnational corporations, on the one hand, and regionalisation, on the other, to question the relevance of the national perspective and the nation state as an analytic category.[28] Nevertheless, numerous attempts to refute such claims have been made by various SI researchers. According to Lundvall, the NSI approach is characterised by a belief in the importance of national systems in supporting and directing processes of innovation and learning, even in the era of globalisation and regionalisation.[29] The coexistence of these divergent trends of simultaneous globalisation/localisation or international unification/diversification is acknowledged as constituting ”two strictly interrelated aspects of contemporary technological change”[30].[31] Though admitting the growing importance of external

[28] Freeman, C. (1995), op cit, p. 15; Nelson, R. R., Rosenberg, N. (1993) Technical Innovation and National Systems. In *National Innovation Systems*: *A Comparative Analysis*. Nelson, R. R. (ed.), Oxford University Press, p. 17; Lundvall, B.-Å. (1988) Innovation as an interactive process: from user-producer interaction to the national system of innovation. In *Technical Change and Economic Theory.* Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L. (eds.), London: Pinter, p. 360; McKelvey, M. (1991), op cit, pp. 4-5; Porter, M. (1990) *The Competitive Advantage of Nations*. London: The Macmillan Press.
[29] Lundvall, B.-Å. (1992), op cit.
[30] Archibugi, D., Michie, J. (1997) “Technological globalisation or national systems of innovation”. *Futures*, Vol. 29, No.2, p. 122.

international connections, such national elements as education system, industrial relations, technical and scientific organisations, government policies, cultural traditions and their influence as still considered fundamental.[32] This argument is also supported by Nelson's study of 15 countries and their respective NSIs[33] where it was concluded that although there are many similarities, there are still a number of elements that demonstrate rather great divergence among different NSIs to mention. These include, among other things, variations reflecting differences in economic and political circumstances and priorities, size and degree of affluence, possession or lack of natural resources, beliefs about the kind of role government should play in shaping industrial development, and characteristic packages of fiscal, monetary, and trade policies, education and training systems.[34] Accordingly, the following arguments or determinants are put forward in order to justify the national perspective[35]:

- market and natural resource specificity;
- higher frequency of informal collaborations within the national economy;
- technically-based interdependencies that are more prone to occur within national economies;
- politically driven linkages and determinants, such as science technology policies, that are basically national in scope;
- the state, and the power attached to it, and the nation as a political entity;
- historical context of a particular country, and institutional path dependency;
- special national features, long-standing traditions, etc.

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[31] Niosi *et al* (1993), op cit, p. 222; Freeman, C. (1995), op cit, p. 16.
[32] Freeman, C. (1995), op cit, p. 5.
[33] Nelson, R. R. (ed.) (1993) *National Innovation Systems*: *A Comparative Analysis*. Oxford University Press.
[34] Nelson, R. R. (1993) A Retrospective. In *National Innovation Systems*: *A Comparative Analysis*. Nelson, R. R. (ed.), Oxford University Press, pp. 506-515.
[35] Niosi *et al* (1993), op cit, p. 211; Edquist, C. (1997), op cit, p. 12, 18-19; Lundvall *et al* (2002), op cit, p. 215; Reger, G., Schmoch, U. (1996), op cit, p. 130.

2.1.5 Concluding remarks

From its very emergence the SI approach has tried to direct or redirect attention to other – previously not considered – factors in the innovation process. The proponents of this approach stress that the contextual framework and the systemic interactions taking place within it are both influenced by historic and institutional aspects of the system under study thus opening up space for a better understanding of the ongoing processes and their outcomes in the field of innovation. Unavoidably, there might be some uncertainty as to the possibilities of its conceptualisation and operationalisation. Nevertheless it can serve as a useful framework for approaching innovation phenomena, and as basis for mapping the field to be studied. The appropriateness and usefulness of a particular SI approach should be determined according to the particular research question and the case one wants to examine. In case of the current research, the NSI approach is seen to be an appropriate one, first of all, as a broader theoretical framework and, secondly, as adequate in the case of a small country like Latvia. Of course, due to the comprehensiveness of the concept, not all of it can be covered within this thesis. Thus a more focused approach of particular segments of the NSI is further elaborated. However, this does not mean abandoning the broader SI framework. Within it, the prime importance is given to the roles and interactions between the major actors, the policy framework, and historically specific factors to be elaborated in the following chapters.

2.2 Triple Helix approach to innovation studies

In order to specify major actors within NSI and to have a deeper comprehension of their roles and interrelatedness another theoretical approach, that of the Triple Helix, is adopted. In relation to the NSI perspective, the TH approach is seen as a useful tool for focusing research.

2.2.1 Basic principles and concepts

Triple Helix approach to innovation studies as a theoretical frame of reference was introduced by Henry Etzkowitz and Loet Leydesdorff.[36] In particular, it has contributed to understanding the changing interactions between university, industry, and government, all of which have lately experienced significant changes in their roles and functions, as well as in their interrelations.[37] The basic assumption underlying this approach is that each of these up to now relatively distinct institutional (public, private and academic) spheres are now assuming tasks that were formerly largely the province of the others, increasingly working together with a spiral pattern of linkages emerging at various stages of the innovation process.[38] According to the TH model, four processes that are related to major changes in the production, exchange and use of knowledge have been identified:[39] (1) internal transformation in each of the helices, (2) the influence of one institutional sphere upon another in bringing about transformation, (3) creation of a new overlay of trilateral linkages, networks, and organisations among the three helices, and (4) recursive effects of these inter-institutional networks representing academia, industry and government, both on their originating spheres and on the larger society.

Interactions among the TH elements is not something brand new, since their development can be traced back to the second half of the 19th century. However, the "codification of the network mode as a regime of university-industry-government communications" is of a rather recent date,

[36] Etzkowitz, H., Leydesdorff, L. (eds.) (1997) *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations*. London: Pinter.
[37] Etzkowitz, H., Webster, A., Healey, P. (eds.) (1998) *Capitalizing knowledge: new intersections of industry and academia.* Albany, NY: State University of New York Press.
[38] Etzkowitz, H., Leydesdorff, L. (1997) Introduction: Universities in the Global Knowledge Economy, p. 2; Etzkowitz, H. (1997) The entrepreneurial university and the emergence of democratic corporatism, p. 143. Both in Etzkowitz, H., Leydesdorff, L. (eds.), op cit.
[39] Etzkowitz, H., Webster, A., Genhardt, C., Terra, B.R.C. (2000) "The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm". *Research Policy,* Volume 29, Issue 2, p. 315.

basically being used only since the early 90s.[40] This codification arose under conditions of increasing acceptance of evolutionary thinking in economics, allowing for the systematic study of interactions between more than two sub-dynamics as sub-systems.[41] Development of the TH approach is also grounded in an increased comprehension of the relevance of technological and academic knowledge to industrial production, as well as social development and the policy questions surrounding these relations.[42]

2.2.2 Triple Helix and SI – complementarity vs. substitution?

According to the above-outlined basic principles of the TH approach, it seems to have originated from a background rather similar to that of the SI approach. One common point of reference for both approaches is evolutionary economics, since the proponents of the TH approach claim to use an evolutionary perspective on innovation analysis.[43] Leydesdorff and Etzkowitz refer to different selection mechanisms, which constitute an important element in evolutionary economics, and they also subscribe to the non-optimality thesis, stating that "under the emerging TH regime of knowledge-based economic developments one can expect an endless transition of innovation, rather than a journey to an assumed ideal model of socialism or capitalism".[44] In the same way, rather extensive references to the interactive character of innovation process are made, thus demonstrating certain common ground in the theory of interactive learning as well. It has been argued, e.g., that "the study of the Triple Helix requires a model that complements the

[40] Leydesdorff, L. (2000) "The triple helix: an evolutionary model of innovations". *Research Policy* 29, p. 252.
[41] Leydesdorff, L., Etzkowitz, H. (2001) "The transformation of university-industry-government relations". *Electronic Journal of Sociology* 5, 4.
[42] Leydesdorff, L., Etzkowitz, H. (2001), op cit.; Leydesdorff, L. (2001) Knowledge-Based Innovation Systems and the Model of a Triple Helix of University-Industry-Government Relations. Paper presented at the conference "New Economic Windows: New Paradigms for the New Millennium", Salerno, Italy, September 2001.
[43] Leydesdorff, L., Etzkowitz, H. (2001), op cit.
[44] Ibid.

institutional perspective with a focus on interactive operations at the system level".[45] Besides, although it does not explicitly state this, the TH perspective also pays a lot of attention to the institutional set-up by looking at the norms and principles underlying academia and industry. Last, but not least, there is a further similarity to SI in that the local specificity and uniqueness of a particular 'system' is occasionally admitted by TH authors by referring to 'nested subsystems' and 'local trajectories' with interaction pattern variations abounding across countries.[46]

However, the relation of the TH model to the SI approach is not so straightforward. Although they might have common grounds there are still some divergences between the two (*see Table 2*). Etzkowitz and Leydesdorff claim the underlying model of TH to be analytically different from that of NSI, since the latter "considers the firm as having the leading role in innovation", while the TH approach focuses on "the network overlay of communications and expectations that reshape the institutional arrangements among universities, industries, and governmental agencies".[47] On the other hand, the reverse argument can be made, that, while the SI approach is more focused on firms and on the demand aspects[48], the TH model deals more extensively with university/academia or the supply side. Thus TH can be seen as a meso-level approach dealing with relations among specific sub-systems, taking a more conceptual or a priori approach directing attention to three specified categories of actors. In contrast, SI approaches are more operational and open-ended, particularly at the macro level of NSIs.

[45] Leydesdorff, L., Etzkowitz, H. (1997) A Triple Helix of University-Industry-Government Relations. In *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations*. Etzkowitz, H., Leydesdorff, L. (eds.), London: Pinter, p. 158-159.
[46] Ibid, p. 159.
[47] Etzkowitz, H., Leydesdorff, L. (2000) "The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix university-industry-government relations". *Research Policy* 29, p. 109.
[48] Edquist, C., Hommen, L. (1999), op cit.

Table 2. *SI & TH: some similarities and differences*

Systems of Innovation	Triple Helix
Common characteristics	
- Evolutionary perspective - Interactive character of innovation process - Coexistence of different interrelated actors - Institutional set-up - National/local differences	
Differences	
- Broader spectrum (open-endness) - Demand aspects	- More focused and strictly defined field - Supply aspects

On the whole, even though differentiating themselves from the SI perspective, the proponents of TH model still make rather extensive use of the SI concept by arguing that "interaction between the different functions [of TH elements] is needed in order to generate and sustain the specific configuration of an innovation system"[49]. Thus it could be argued that the TH model takes the SI approach as the broader framework examining more specifically the relations between the three identified types of actors, since it is noted that the result of the interactions underlying the TH model "increasingly form the basis of regional, national, and multinational innovation systems in various parts of the world".[50] However, there is still very limited communication between these two theories, especially on behalf of the SI perspective advocates who make almost no reference to the TH approach. Accordingly, this thesis makes an attempt to bring these two perspectives together and use them as mutually complementary and enriching, rather than opposing approaches to innovation studies. The foregoing discussion is also partly an answer to the theoretical research question concerning their compatibility. Unavoidably, there are both

[49] Leydesdorff, L., Etzkowitz, H. (2001), op cit.

common stands and differences between the two. Nevertheless, their origins are rather similar, with only some focus distinctions that simply enrich our perception of the broader phenomena of innovation processes.

2.3 Defining technology transfer

Irrespective of the major or minor differences between the two approaches addressed above, in one way or another they both deal with issues related to the interactions between different actors within the innovation system. And they both address the possibilities of improving the innovation process, which is seen as crucial for the development of countries nowadays. Such improvements can occur through different mechanisms, one of which is the linking of industry and academy. Since the ultimate focus of this research is on IISOs and their role in providing means for the stimulation of this link between the TH elements within NSI, it becomes essential to define what is understood by this linkage through the concept of technology transfer.

2.3.1 Definitions

There is a wide range of literature implicitly or explicitly addressing the issue of technology transfer and applying this concept since the early 1970s, thus providing a wide range of definitions of this phenomenon (*see Table 3*). On the one hand, their variety can be explained by the different disciplines and purposes of particular research projects.[51] On the other hand, and on a more general level this diversity arises from the fact that perceptions about the nature of the

[50] Etzkowitz, H., Leydesdorff, L. (1998) *A Triple Helix Model of Innovation in University-Industry-Government Relations.* Abstract of conference paper. International Sociological Association.
[51] Bozeman, B. (2000) "Technology transfer and public policy: a review of research and theory". *Research Policy* 29, p. 630.

transfer process are based on the underlying understanding of the innovation and innovation process *per se*, which has changed substantially over time.[52]

Table 3. *Selected definitions of technology transfer*

Roessner	Technology transfer is the movement of know-how, technical knowledge, or technology from one organisational setting to another.[53]
Bessant and Rush	Technology transfer is the process through which technology moves from outside sources to the organisation[54].
Williams and Gibson	In a broad view, technology transfer reflects all or some components of the process of moving ideas from the research laboratory to the marketplace.[55] Technology transfer is the iterative movement of (this) applied knowledge via one or more communication channels, with its communicating agents (..) being dyads structured as groups or organisations.[56]
Leonard-Barton	Technology transfer usually involves some source of technology, possessed of specialised technical skills, which transfers the technology to a target group of receivers who do not possess those specialised skills and who therefore cannot create the tool themselves.[57]
Laamanen and Autio	Technology transfer is the active interaction between two or more social entities during which the sum of technological knowledge remains stable or increases through the transfer of one or more components of technology.[58]

These selected definitions vary in their scope and coverage, which makes it harder to establish precise boundaries of this phenomenon, however certain steps can be taken in order to overcome this vagueness. An initial distinction has to be made between domestic and international or cross-

[52] E.g., Bessant, J., Rush, H. (1995) "Building bridges for innovation: the role of consultants in technology transfer". *Research Policy* 24, pp. 97-114; Roberts, R. (1998), op cit.
[53] Roessner as cited by Bozeman, B. (2000), op cit, p. 629.
[54] Bessant, J., Rush, H. (1995), op cit, p. 97.
[55] Williams, F., Gibson, D.V. (1990) Introduction. In *Technology Transfer: A Communicative Perspective*. Williams, F., Gibson, D.V. (eds.), Sage Publications, p. 10.
[56] Ibid, p. 13.
[57] Leonard-Barton, D. (1990) The Intraorganisational Environment: Point-to-Point Versus Diffusion. In *Technology Transfer: A Communicative Perspective*. Williams, F., Gibson, D.V. (eds.), Sage Publications, p. 45.
[58] Laamanen, T., Autio, E. (1993) *Technology Transfer between Research Laboratories and Industry: Measurement and Evaluation*. Technical Research Centre of Finland, Espoo, VTT Research Notes 1507, p. 16.

national technology transfer.[59] Traditionally, much research has focused on the latter, by examining technology transfer from developed countries to developing countries, thus implying transfer across the boundaries or borders of a particular country. Such research is referred to as "developing country oriented technology transfer research".[60] On the other hand, the concept of domestic transfer or "innovation oriented technology transfer research" limits the scope of research to the transfer process between different units within a selected country.[61]

A further strategy to operationalise a given concept of technology transfer can be accomplished by a closer examination of the constituting elements of the technology transfer process - respectively, 'transfer agent', 'transfer object', 'transfer mechanisms', 'transfer media', and 'technology recipient'. This division into elements can provide a more elaborate understanding of this rather complex process.[62] However, it is important to comprehend that technology transfer is not an instantaneous event but a time-based process - a complex activity involving multiple actors and elements and various different patterns of interrelationship with a different set of influential participants and issues at each stage in the process.[63] Though not yet reflected in all the above given definitions it is increasingly acknowledged that the process is a two-way or bi-directional interaction rather than a one-way transfer.[64] Thus, most definitions reject the linear view of the transfer process and accept, instead, an interactive one – which also forms the bases

[59] Bozeman, B. (2000), op cit, p. 630.
[60] Laamanen, T., Autio, E. (1993), op cit, p. 7.
[61] Ibid.
[62] Bozeman, B. (2000), op cit, p. 628, 629, 637; Buratti, N., Penco, L. (2001) "Assisted technology transfer to SMEs: lessons from an exemplary case". *Technovation* 21, p. 36.
[63] Bessant, J., Rush, H. (1995), op cit, p. 98.
[64] Meyer-Krahmer, F., Schmoch, U. (1998) "Science-based technologies: university-industry interactions in four fields". *Research Policy* 27, p. 842.

of SI and TH approaches.[65] Now, more often the sharp distinction between the transfer agent and recipient is being blurred, and it is used only for analytical purposes, as is also done here.

2.3.2 Transfer agent

By transfer agent, 'donor'[66], 'source'[67] or 'transferor'[68] one usually means university, a research centre, or R&D departments of firms[69]. Essentially, this is the action subject, represented by either an individual or organisation that generates or provides the elements to be transferred. When speaking about the transfer agent, it is argued that such issues as the nature of the organisation, its history and culture have to be taken into account[70]. This position, shared with both NSI and TH, does not apply only to the transfer agent, but rather to the whole process of technology transfer.

2.3.3 Transfer object

The concepts of 'technology transfer' and 'technology recipient' obviously point to technology as the transfer object. However, it is important to define what one means by technology. In many cases the technology is seen as hardware or a physical artefact, which considerably limits our understanding of the characteristics of technology. In order to avoid this misconception it is important to speak also about 'knowledge transfer', which is in many respects closely linked to the notion of 'technology transfer'. The link between these two concepts is rather inevitable, due to the fact that it is not merely the product that is transferred but also knowledge of its use and

[65] Buratti, N., Penco, L (2001), op cit, p. 36; Williams, F., Gibson, D.V. (1990), op cit, p. 16.
[66] Buratti, N., Penco, L. (2001), op cit.
[67] Williams, F., Gibson, D.V. (1990), op cit.
[68] Laamanen, T., Autio, E. (1993),op cit, p. 8.
[69] Buratti, N.,Penco, L. (2001), op cit, p. 36.
[70] Bozeman, B. (2000), op cit, p. 639.

application.[71] Thus, one has to take into consideration the multi-dimensional character of transfer objects and technology transfer in general, as these are reflected in the forms, mechanisms, and media by which technology is transferred - be it tangible, embodied, codified or tacit.[72]

2.3.4 Transfer mechanisms

A wide range of possible variants of transfer modes have been considered in both the theoretical and empirical literature, which also refers to 'transfer mechanisms' and 'transfer channels'. A technology transfer mechanism is "any specific form of interaction between two or more social entities during which technology is transferred", while a technology transfer channel is "the link between two or more social entities in which the various technology transfer mechanisms can be activated". [73] From the perspective of the technology recipient, Padmore *et al* have distinguished between four transfer channels of innovation knowledge: (1) embodiment in acquired goods, (2) embodiment in acquired services, (3) acquisition of intellectual property, and (4) acquisition of human capital.[74] On the other hand, Etzkowitz *et al* identify three degrees and mechanisms of academic involvement for the transfer agent: (1) the product originates in the university but its development is undertaken by an existing firm, (2) the commercial product originates outside of the university, with academic knowledge utilised to improve the product, or (3) the university is the source of the commercial product and the academic inventor becomes directly involved in its commercialisation through establishment of a new company.[75] In more concrete terms the most commonly cited transfer mechanisms are contract research, co-operative research, sponsored

[71] Ibid, p. 629.
[72] Bessant, J., Rush, H. (1995), op cit, p. 98.
[73] Laamanen, T., Autio, E. (1993), op cit, p. 17-18.
[74] Padmore, T., Schuetze, H., Gibson, H. (1998) "Modelling systems of innovation: an enterprise-centred view". *Research Policy* 26, p. 616-617;
[75] Etzkowitz, H. (1998) "The norms of entrepreneurial science: cognitive effects of the new university-industry linkages". *Research Policy* 27, p. 827.

research, workshops, seminars, licensing, patent purchase, publication screening, consultancy, staff exchange, education of personnel, student training, use of lab facilities, lab visits, spin-offs, informal contacts etc.[76]

2.3.5 Transfer media

Though the terms are sometimes used interchangeably, a differentiation between concepts of transfer mechanism and transfer media should be made. If transfer mechanisms are the ones listed above, then transfer media can be defined as the external conditions or milieu where the transfer is carried out or encouraged. Among these, the importance of different intermediaries is stressed.[77] It is noted that interface organisations are essential to effective analysing, planning and implementation of the transfer process by promoting awareness among technology recipients of their needs, by monitoring technology markets, by guiding the initiation and successful process of technology transfer, and by assisting technology recipients in technology adoption.[78]

2.3.6 Technology recipient

As to the technology recipient, several authors distinguish between transfer from a single source to one receiver site (point-to-point transfer) and transfer from a single source to multiple receiver sites (diffusion).[79] Sometimes the distinction between these two modes is made by referring to diffusion as passive while characterising point-to-point transfer as an active and intentional process.[80] The respective receiver site, or the technology recipients, are sometimes also referred

[76] E.g., Bozeman, B. (2000), op cit, p. 641; Stankiewicz, R. (1986). *Academics and entrepreneurs: Developing university-industry relations*. St. Martin's Press Inc., New York, pp. 44-67.
[77] Bessant, J., Rush, H. (1995), op cit.
[78] Buratti, N., Penco, L. (2001), op cit, p. 36.
[79] Leonard-Barton, D. (1990), op cit.
[80] Laamanen, T., Autio, E. (1993), op cit.

to as 'destinations'[81], or 'transferees'[82], and these can either be governmental agencies, non-profit organisations, or businesses.[83] However, one usually means by technology recipients the firms that may either directly use or co-develop the technology.[84]

2.3.7 Concept application

Given these theoretical concepts, the following scheme can be made for their application in the current research (*see Table 4*). Initially, it should be clarified that by choosing to adopt the framework of NSI and TH approaches, this research focuses mainly on the domestic technology transfer, although international aspects are touched upon as well. The primary transfer source in the current research is identified as higher education and research organisations. Accordingly, the transfer media is embodied first of all in the particular NSI - and, on a more particular level, in IISOs - while the recipients are firms hosted by these organisations. As to the transfer mechanisms, the whole spectrum of those listed above in section 2.3.4 is initially taken into consideration, with final selection being made through the analysis of research results. The same is true as to the transfer object. This research deals primarily with the point-to-point transfer mode, thus paying less attention to the diffusion process.

Table 4. Technology transfer scheme application

Transfer agent	Transfer object	Transfer media	Transfer mechanism	Technology recipient
Higher education and research organisations	*Technology (embodied, codified, tacit)*	*Intermediary innovation support organisations*	*Interaction (knowledge communication)*	*Tenant companies*

[81] Williams, F., Gibson, D.V. (1990), op cit, p. 13.
[82] Laamanen, T., Autio, E. (1993), op cit, p. 8.
[83] Bozeman, B. (2000), op cit, p. 643.
[84] Buratti,N., Penco,L. (2001), op cit, p. 36.

2.4 Intermediary innovation support organisations

As already noted above, different technology transfer media are considered to play an increasingly important role in promoting innovative development. In this respect, one of the subsystems of the NSI can be seen as being formed by different IISOs that operate within a particular country and that are basically initiated by governmental bodies in order to create a supportive environment for new technology-based firms. Since this kind of organisation is of prime interest for the empirical study of this thesis, the following section will develop insight into their origins, functions and some previous research carried out on them.

2.4.1 Origins and functions

The idea of IISO originally came from the USA. Stanford Industrial Park, Silicon Valley, Research Triangle Park and Route 128 were initial US examples of this kind of organisation in the 1950s, and were enthusiastically followed by European countries in the coming decades.[85] The original idea of IISOs was to provide assistance for the technology transfer from the academy to industry, but over time a range of other functions and tasks have been added[86], e.g., given the cuts in university funding as an external stimulus for their own commercial activities. These organisations have taken various forms as well as various names in different times and different places. This could be due to the diversity of local contexts - various degrees of development and the particular needs of regions and countries - as well as evolution of the idea

[85] Stankiewicz, R. (1986), op cit, p. 68; Massey, D., Quintas, P., Wield, D. (1992) *High-tech Fantasies: Science parks in society, science and space*. Routledge, p. 9; Roberts, R. (1998), op cit, p. 169; Storey D.J., Tether, B.S. (1998) "Public policy measures to support new technology-based firms in the European Union". *Research Policy* 26, p. 1037-1040.

[86] Sanz, L. (2001) "Becoming knowledge farms: the role of science/technology parks in the knowledge economy". Paper presented at the conference "Baltic Dynamics 2001", Riga, Latvia, September 14-16.

over time.[87] The end result has been, in any case, a great variety of existing 'models'.[88] Accordingly, the relevant literature is full of a wide range of terms like 'science park', 'technology park', 'research centre', 'technopole', 'research park', 'innovation centre', 'business incubator', 'technocell', 'industrial zone', 'industrial park' and number of other terms that have to do with business support. However, these can be disaggregated, first, on the basis of whether they aim to support business in general or specifically innovative businesses, and, second, according to whether they provide services and/or infrastructure. The primary interest in this research is on organisations supporting innovative business by providing them with both infrastructure and services, thus limiting the available spectrum of coverage. Nevertheless, even after this elimination, variations still abound. By now, several international as well as numerous national associations have been formed for bringing together the representatives of these organisations in order to share their experiences, arrive at common problem solutions, and establish some common standards and principles of operation, which are also reflected in definitions of various kinds of IISOs and their tasks (*see Table 5*).

As can be inferred from these definitions, each of these forms of IISOs has some certain specificity, however, there are several basic elements that are present in all of them. Among these one could mention: (a) existence of managerial staff, (b) provision of physical infrastructure and (c) services, as well as (d) orientation to small, high-tech companies as the main tenants, and (e) facilitation of technology transfer as one of the main tasks.

[87] Gibb, J.H. (1985) *Science parks and innovation centres: their economic and social impact*. Proceedings of the conference held in Berlin, 13-15 February 1985. Commission of the European Communities. Amsterdam: Elsevier Science Publishers.
[88] Sanz, L. (2001), op cit.

Table 5. *Key definitions of IISOs*

Organisation	*Definition of IISOs*
International Association of Science Parks (IASP) [89]	A ***Science Park*** is an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To reach these goals a Science Park stimulates and manages the flow of knowledge and technology amongst Universities, R&D institutions, companies and markets; facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services as well as high quality space and facilities. This definition encompasses also other terms such as Technology Parks, Research Parks, Technology Precincts, Technopoles and the like. It is not implied that such terms are always synonymous, but the IASP definition comprises those aims and features that are common to all of them.
United Kingdom Science Park Association (UKSPA) [90]	A ***Science Park*** is a business support initiative whose main aim is to encourage and support the start-up and incubation of innovative, high-growth, technology-based businesses through the provision of: (1) infrastructure and support services including collaborative links with economic development agencies; (2) formal and operational links with centres of excellence such as universities, higher educational institutes and research establishments; and (3) management support actively engaged in the transfer of technology and business skills to small and medium-sized enterprises.
Association of University Research Parks (AURP) [91]	A ***university research park*** is a property-based venture which has: ▪ existing or planned land and buildings designed primarily for private and public R&D development facilities, high technology and science based companies, and support services; ▪ a contractual and/or formal ownership or operational relationship with one or more universities or other institutions of higher education, and science research; ▪ a role in promoting R&D by the university in partnership with industry, assisting in the growth of new ventures, and promoting economic development; a role in aiding the transfer of technology and business skills between the university and industry tenants. Research Park' is an expression often used in the USA, whereas in Canada, Europe, Asia and Latin America, expressions such as Scientific Park or Technology Park are preferred.

[89] International Association of Science Parks (IASP) http://www.bida.es/clientes/IASP/information/definitions.php
[90] United Kingdom Science Park Association (UKSPA) http://www.bida.es/clientes/IASP/information/definitions.php
[91] Association of University Research Parks (AURP) http://www.bida.es/clientes/IASP/information/definitions.php; http://aurrp.org/whatis/index.html

National Business Incubation Association (NBIA) [92]	***Business incubation*** is a dynamic process of business enterprise development. Incubators nurture young firms, helping them to survive and grow during the start-up period when they are most vulnerable. Incubators provide hand-on management assistance, access to financing and orchestrated exposure to critical business or technical support services. They also offer entrepreneurial firms shared office services, access to equipment, flexible leases and expandable space - all under one roof.
Latvian Association of Technological Parks, Centres and Business Incubators (LTICA)[93]	A ***Technological/Innovation Centre*** (TC) is a structure, which can offer services and support mainly to technology-oriented (knowledge-based) enterprises. Basically, a TC has 3 functions: the same as for the business incubator (rooms for lease, technical and secretarial services, telecommunications, etc.); specialized consultations and information to technology-oriented business, a support in the participation in exhibitions and international cooperation, advertising new products, etc.; advisory services for getting loans and other kind of financial support. A ***Science / Technology Park*** (TP) is a defined area of land and a complex of several buildings to be used for knowledge/technology based research, development and production. Here can be located a number of higher educational and research institutes, technological/innovation centres, business incubators, consultant bureaus, service centres, etc. The basic function of a TP is to manage this area and buildings for the efficient development of high-tech business and to provide permanent links between research laboratories and technology-oriented companies and to promote the establishment and growth of new innovative companies, including joint venture companies. Usually the TP are established near Universities or Research centres. For the TP tenant companies it is possible to provide certain fiscal and economic privileges.

It can be noted, though, that the IASP definition is applicable not only to science parks but also to other mentioned IISOs. Similar implications arise from the AURP definition, where the notions of 'park' and 'incubator' are used almost as synonyms, and where reference to different name preferences in different parts of the world is made. Besides it could be argued, that the available definitions of various IISOs are still well open in order to not eliminate any potential candidates to be located within those. These observations support the conclusion that the selection of the name might occasionally have something to do with 'taste', rather than exclusively with some

[92] National Business Incubator Association (NBIA). http://www.bida.es/clientes/IASP/information/definitions.php
[93] Latvian Association of Technological Parks, Centres and Business Incubators (LTICA) http://www.innovation.lv/LTICA.htm

highly distinct functions and operation principles. This view is also held by Roberts, who proposes to cover all these terms under 'innovation intense environments', which he defines as "special places, which are purported to accelerate the rate of innovation and proliferation of new high technology products and industries"[94]. As this author argues, "in spite of debate over appropriate form, all terms fundamentally denote special environments in which the stages of the innovation process can be both accelerated and controlled".[95] Besides it has to be acknowledged that not all organisations named after one of the above-mentioned terms can be attributed the characteristics of an IISO and not all organisations fostering innovative business and fulfilling the respective functions contain the above-mentioned terms in their names. Thus, in order to define an organisation as one supporting innovation, one has to look not only for its name, but also for the functions it aims to perform.

2.4.2 Efficiency assessment

Whatever we name the organisations discussed above, the thing that is of prior importance is how effective they are in actually performing their tasks. There is a range of views on their performance, but one is again confronted with divergent evidence and opinions ranging from highly laudatory to strictly negative and sceptical ones.

Despite their rather extensive promotion in different policy documents on both EU and national levels, it is notable that academic studies of IISOs have generally tended to be quite critical of their underlying assumptions and actual performance.[96] These organisations have been criticised for relying on an outdated, linear, model of innovation, thus reflecting an assumption that

[94] Roberts, R. (1998), op cit, p. 160, 169.
[95] Ibid, p. 170.

technological innovation stems from scientific research and that IISOs can provide the catalytic incubator environment for the transformation of 'pure' research into production.[97] This argument is put forward by Massey *et al* in their seminal work *High-tech Fantasies: Science parks in society, science and space* where they argue that these parks are based on "a rigid and not necessarily very productive model of invention and innovation"[98], since "at the core of the science-park concept lies the idea that scientific knowledge leads in some linear progression to technological innovation"[99]. Their main critique is directed against the postulated aims and tasks attached to this kind of IISO, and its actual operation in regard both to the tenant firm selection and IISO performance, which in many cases is not consistent.

A somewhat less critical stand is taken by other researchers, who conclude that location in, e.g., a science park does not significantly influence the growth and survival of the new technology based firms (NTBF), but the existence of these IISOs is likely to stimulate the formation of NTBFs that would not otherwise have been established and thus "constitutes an 'economic' magnet for the clustering of technology-based firms which enhances local economic development".[100] It is also argued that although the location in a science park might not make any substantial contribution to innovation, it "does confer status and prestige and these indirectly promote technology transfer and information flows".[101] Another point to be made here is that recently it has been acknowledged that much of the success or efficiency of an IISO depends on the quality and managerial skills of the management of the particular organisation.[102]

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[96] Phillimore, J. (1999), op cit, p. 674.
[97] Ibid, p. 673; Westhead, P., Storey, D. J. (1995), op cit, p. 349.
[98] Massey *et al* (1992), op cit, p. 3.
[99] Ibid, p. 34.
[100] Storey, D. J., Tether, B. S. (1998), op cit, p. 1040.
[101] Bozeman, B. (2000), op cit, p. 641.
[102] Sanz, L. (2001), op cit.

Another way to evaluate the performance of these organisations is seen in the comparison between the performance of firms located on and off these sites.[103] This seems to be a very promising and grounded approach. Again no uniform and consistent results have been yielded by the empirical studies carried out by different researchers. There exists divergent evidence in regard to whether there are substantial, slight, or indistinct differences between the two groups of firms. One reason for these variations might be attributed to the different countries, different aspects, and different samples selected for the respective surveys. Besides it also has to be taken into account that these organisations are in many countries a rather recent development, besides their long-term objectives are difficult to evaluate conclusively in the early stages of their development.[104]

It can be observed that the evaluation aspect mostly involves referring to success and efficiency, which are widely used terms but rarely comprehensively defined or operationalised. Many researchers avoid defining them at all, while others acknowledge that this kind of evaluation is based on highly subjective approaches and views. As noted by Bozeman, many of these studies "never make clear what is meant by effectiveness and seem simply to assume that we all hold some unspecified unitary concept of effectiveness".[105] One proven practical solution to this problem already touched upon above and also further utilised in this study, is offered by Massey *et al*, whereby the evaluation of the success of these organisations is determined in relation to their self stated aims and goals. In line with this approach, evaluation should seek to determine

[103] E.g., Westhead, P., Storey, D.J. (1995), op cit; Ferguson, R. (1999) *What's in a Location? Science Parks and the Support of New Technology-based Firms*. Doctoral thesis. Swedish University of Agricultural Sciences. Uppsala; Colombo, M. G., Delmastro, M. (2002) "How effective are technology incubators? Evidence from Italy". *Research Policy*, Vol. 31, Issue 7, pp.1103-1122; Lindelöf, P., Löfsten, H. (2002) "Growth, management and financing of new technology-based firms – assessing value-added contributions of firms located on and off Science Parks". *Omega*, Volume 30, Issue 3, June, pp. 143-154.
[104] Storey, D. J., Tether, B. S. (1998), op cit, p. 1040, 1041.

whether and how these aims and tasks are accomplished, analysing organisations "on their own terms based on their own self-conceptualisation and on their own stated objectives".[106] Massey et *al* refer to this as the 'popular conceptualisation' which is used, e.g., in the policy literature produced by the IISOs themselves, and later reproduced by other interested subjects, and which consists of the actual definition and postulated causal relations and effects that are expected to result from the stated characteristics.[107]

It has to be admitted that the review of available studies gives a better understanding of the researchable elements, potential bottlenecks and analytical tools that can be used in investigation of IISOs. However, the literature does not provide a coherent and uniform picture of the actual efficiency of this kind of initiative. The divergent results and evaluations are altogether rather confusing, asking for further research in the field in order to find at least some basic common principles underlying the operation and success or failure of IISOs. Notably, very little investigation in this field has been done so far in the context of newly independent post-soviet countries confronted with the new mechanisms of a market economy.

3. METHODOLOGY

Based on the theoretical concepts outlined in the preceding chapters, an empirical study has been carried out in order to see their application in 'real life' and to generate some additional insights into the related issues in a particular setting. In this chapter, a brief overview is given of the study's methodological approach and the specific methods used in gathering the relevant data, as well as ethical and generalisability/validity issues.

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[105] Bozeman, B. (2000), op cit, p. 637.
[106] Massey *et al* (1992), op cit, p. 29.

3.1 Qualitative vs. quantitative approach

In order to obtain the necessary data for answering the stated research questions initially application of both qualitative and quantitative methods was planned. The research design did not advocate taking sides in the 'paradigm wars'[108], and adopted Flick's standpoint that "qualitative and quantitative research are not incompatible opposites which should not be combined"[109]. However, after a closer initial familiarisation with the selected cases, a choice was made in favour of the qualitative approach, dictated by the historical and institutional specificity in comparison to similar cases studied before. It was acknowledged that the phenomenon to be studied was far from well comprehended within the given social, political and economic context thus demanding a deeper exploration than could be possible with quantitative methods. The latter are usually used when quantitative characteristics of a known phenomenon have to be revealed. At the same time, several complementary research methods were chosen in order to achieve as broad a coverage of the particular research issue as possible, thus ensuring data triangulation. Taking data from several sources increases one's chances of being able to establish trustworthy results.[110]

3.2 Case studies

The basic approach adopted for accomplishing the study is the case study strategy with its basic idea that a limited number of cases are studied in detail, with the main objective being to "understand the case in depth, and in its natural setting, recognising its complexity and its

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[107] Ibid, p. 13.
[108] Oakley, A. (2000) Paradigm Wars (Chapter 2). In *Experiments in Knowing: Gender and Method in the Social Sciences*, pp. 23-43. London: Polity Press.
[109] Flick, U. (1998), op cit, p. 40.
[110] Ibid, p. 50; Oakley, A. (2000), op cit, p. 67.

context".[111] As noted by Yin, case studies are especially appropriate (a) for answering 'how' and 'why' questions, (b) when the investigator has little control over events, and (c) when the focus is on a contemporary phenomenon within real-life context.[112] Since the research questions posed and the research area specified met all these criteria, the case study approach was selected as the most appropriate one.

In order to identify a particular case for study, case sampling was carried out. Accordingly, Flick's division between 'case sampling' and 'sampling groups of cases' was used, whereby the former implies, e.g. in an interview study, the decision about which persons to interview, and the latter from which groups these should come.[113] This procedure is outlined also by Yin, who stresses paying attention to the general definition of the case, followed by further clarifications of the unit of analysis.[114] With reference to the principles outlined above, research is based upon what Yin refers to as 'multiple embedded case studies'[115] of two IISOs in Latvia - the Latvian Technological Centre (LTC) and the Latvian Technology Park (LTP). Further according to Yin, embeddedness often implies that "the same case study may involve *more than one unit of analysis*" which occurs "when, within a single case, attention is also given to a subunit or subunits"[116]. Based on this principle, this research deals with multiple units of analysis, respectively - (1) host organisations, and (2) firms hosted by these organisations.

Case selection for this study was based on theoretical, rather than statistical, sampling. Thus, the cases are not considered to be statistically 'representative', but theoretically 'typological'. The

[111] Punch, F. K. (1998), op cit, p. 150.
[112] Yin, R. K. (1994) *Case study research: design and methods*. 2nd ed. London: Sage Publications. p. 13.
[113] Flick, U. (1998), op cit, p. 62.
[114] Yin, R. K. (1994), op cit, pp. 31-33.

main sampling criteria for 'groups of cases' were (1) time of operation, (2) activity, and (3) branch coverage. The first criterion was based on the argument that recently established organisations of this kind might not provide a substantial source of analysis at this particular moment, since it takes some time before any results can be achieved. The second criterion was based on the argument that there should be a certain level of relevant activity in order to study more dynamic cases. Finally, cases with unlimited branch coverage were given priority to avoid branch specific bias and to provide bases for better case comparability. Based on the three outlined criteria, two IISOs in Latvia were selected that in their coverage group have been on the scene for the longest period of time and have declared co-operation between scientific and business communities as one of their main areas of activity. As to the 'case sampling' three as far as possible divergent tenant firms were selected in each 'case group', based on their location and main business activity.

3.3 Methods

3.3.1Interviews

One of the most important sources of information in case studies is widely considered to be interviews, as interviews are said to be "a very good way of accessing people's perceptions, meanings, definitions of situations and constructions of reality".[117] In this study, interviews were used as one of the main data collection methods, with 2 semi-structured interviews conducted with the leading managers of LTC and LTP and 6 (3+3) semi-structured interviews with tenant firm managers of these organisations.[118] The first two interviews can be classified as 'data based

[115] Ibid, p. 58.
[116] Ibid, p. 49.
[117] Ibid, pp. 88-91; Punch, F. K. (1998), op cit, pp. 174-184.
[118] See interview questions and interview lists in Appendices (1-3).

on privileged information', where the justification for interviews is based on the value of contact with key players in the field who can give privileged information.[119] In turn, the other interviews were used for data triangulation purposes, in order to have representation of the different views given from different perspectives of host and tenant. Additionally, interviews with the concerned actors available in local newspapers were used where appropriate. As a complementary source of evidence in the form of observations of the LTP/LTC environment in terms of physical infrastructure, location and general attractiveness during the interview arrangement/visit was collected.

3.3.2 Document analysis

Another method commonly used in case studies, and also applied in this research is document analysis, since both historical and contemporary documents are a rich source of data for social research.[120] Besides, when used in conjunction with other methods and data types, documents can be important for triangulation, mentioned above.[121] There are a wide variety of documents that can be used for analysis. However, in the current study the relevant documents include, on the one hand, governmental documents in the form of related programmes, strategies and laws representing the policy dimension. On the other hand, the home pages of the selected organisations were also used as sources of information, mainly in regard to their self-presentation and self-image dimension, constituting an important element in further analysis and interpretation of interview data.

[119] Dencombe, M. (1998) *The Good Research Guide for small-scale social research projects*. Open University Press. p. 111.
[120] Punch, F. K. (1998), op cit, p. 190.
[121] Ibid.

3.4 Ethical considerations

As in almost any social research there was a set of ethical issues that had to be taken into account and clarified in regard to procedures before, during and after 'entering the field'. In the current research the field was approached by the researcher as an employee of her current workplace which is a public research organisation thus potentially adding more respect to the researcher's status. In regard to interviews, the anonymity issue was negotiated with respect to identifying the respondent in the final material. As to the identification of the two selected organisations, the decision was made to disguise them since, first of all, this is the practice commonly used by other researchers in this field, secondly, there is a little likelihood that in such a small sample their identity could be hidden, and, thirdly, there were too many research questions that couldn't be answered without giving particular details about the selected cases.

3.5 Generalisability and validity

The final issue that has to be clarified and that is repeatedly stressed when analysing pros and cons of the case study approach concerns its generalisability. According to Yin "analogy to samples and universes is incorrect when dealing with case studies (..) because survey research relies on *statistical* generalisation, whereas case studies rely on *analytical* generalisation"[122]. With the latter type of generalisation "a previously developed theory is used as a template with which to compare the empirical results of the case study"[123]. The generalisability of this study is considered to be rather high since the selected organisations can be considered as typical and taken from a very limited population of this kind of organisations in the given country. In

[122] Yin, R. K. (1994), op cit, p. 43, italics original.
[123] Ibid, p. 38.

addition, its generalisability is also supported by underlying theoretical implications of a broader scope, with the cases being used to contribute tests of existing theories.

In its turn, research validity[124] is secured by this generalisability – particularly, *external validity*, or establishment of the domain to which a study's findings can be generalised. *Reliability*, i.e., insuring that operations of a study can be repeated with the same results, is achieved by providing the readers with the list of main interview questions, as well as a list of the reviewed literature. Further, *construct validity,* which refers to establishing correct operational measures for the concepts being studied, is accomplished through the use of multiple sources of evidence, reviewed above. Finally, *internal validity*, requiring to establish a causal relationship between conditions, is achieved by trying to establish this relationship between the identified variables.

3.6 Concluding remarks

The chosen methodological framework and the particular methods have both resemblance with those used in other similar studies as well as some particularities. Case study approach is the one most commonly used in studying IISOs with some variations in the number of the cases as well as their geographical location. Similarly, the document analysis is rather widely distributed among IISO researchers. However, as to the general methodological approach, this kind of studies tends to be more of a quantitative kind with questionnaire surveys as the main data gathering method. In this respect, the current research is somewhat different by using a less widely applied method (in this research area) of semi-structured interviews. These are expected to provide a better initial insight into the problem area, which might be better comprehended or at least more widely studied in contexts other that post-soviet countries.

4. IMPLICATIONS FOR POST-SOVIET COUNTRIES

Following the outline of the key concepts and theories as well as more clear-cut identification of the empirical case study framework, this section takes the form of an applied theoretical chapter. Since the second theoretical research question of this study concentrates on the application of the previously discussed theories and concepts to the transitional economies and in particular to the Central and Eastern European countries (CEECs), then some review of already available projections is in order here. An additional aim for doing this is to outline the historical and social context of the developments in these countries as the background for the selected case study, since the adopted NSI approach emphasises the role of path-dependency and context specific aspects in its analyses. Of course, the development patterns of these different countries vary. However, there are some basic characteristics inherited from the socialist period that are common and might be considered essential.

4.1 Emergence of the National systems of innovation

When analysing the transformations now occurring in the former socialist countries in regard to R&D, many actors voice a common view that these countries were formerly characterised by what has been defined as the socialist science and technology system (S&TS), which was based on a linear model of innovation.[125] They argue that this model reflects the institutional separation of R&D that was present in these countries, whereby innovation was separated from production

[124] Yin, R. K. (1994), op cit, pp. 40-45.
[125] Meske, W., Mosoni-Fried, J., Etzkowitz, H., Nesvetailov, G. (eds.) (1998) *Transforming Science and Technology Systems – the Endless Transition?* NATO Science Series 4: Science and Technology Policy, Vol. 23. Amsterdam: IOS Press; Radosevic, S. (1999) "Transformation of science and technology systems into systems of innovation in central and eastern Europe: the emerging patterns and determinants". *Structural Change and Economic Dynamics* 10, pp. 277-320; Acha, V., Balazs, K. (1999) "Transitions in thinking: changing the mindsets of policy makers about innovation". *Technovation* 19, pp. 345-353; Chataway, J. (1999) "Technology transfer and the restructuring of science and technology in central and eastern Europe". *Technovation* 19, pp. 355-364. Balazs, K., Faulkner, W.,

and the market.[126] In many cases, an NSI is seen as the transformation outcome. However, opinions differ slightly as to whether it is an already present or only emerging or potential one.

According to Slavo Radosevic, it is obvious that one can't speak of SI in socialist economies. He argues in favour of a gradual emergence of different SIs in these countries as an "outcome of mutual interaction of historical heritage, especially organisational path-dependency, recombination of existing competencies into new organisational forms, and radical economic change generated by new incentives and opportunities".[127] Still, he does not acknowledge that NSIs have already been formed, since "extensive organisational superstructure and R&D capacities should not be confused with the notion of innovation system, which implies knowledge links and knowledge flows in the innovation process as a collective activity".[128] From this perspective the emergent NSIs in the former socialist countries are still considered to be very fragmented and rudimentary.

The reference to the transformation from the socialists S&TS to an emerging post-socialist innovation system is explicitly made also by Hirschhausen and Bitzer.[129] These authors make a clear distinction between socialist S&TSs and capitalist innovation systems, which is marked by an overarching role of the state, fully secured government funding and decision making on merely political rather than monetary bases in the former, and private initiative, market mechanism operation, and monetary constraints in the latter. The abrupt change experienced by

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Schimank, U. (1995) "Transformation of the Research Systems of Post-Communist Central and Eastern Europe: An Introduction". *Social Studies of Science*, Vol. 25, No 4, pp. 613-632.
[126] Radosevic, S. (1999), op cit, p. 281-282.
[127] Ibid, p. 281.
[128] Ibid, p. 302-303.
[129] Hirschhausen, C. von, Bitzer, J. (eds.) (2000) *The Globalisation of Industry and Innovation in Eastern Europe: From Post-socialist Restructuring to International Competitiveness*. Edward Elgar.

post-socialist countries is even seen by these authors as a technology trajectory change or paradigm shift in S&T field, due to the marked differences in both the perception of innovation per se and the actor interplay and role division – a change from top-down to bottom-up approaches. Naturally, this major change and the current shift to the knowledge–based economy couldn't be realised on the spot, since the preconditions existing in the west were not present in post-socialist countries, where they have to start with a "fragmented and devalued S&TS"[130].

This gradual change is analysed by Werner Meske in his "three–phase model", where the first phase is characterised by a dissolution of the former socialist system, the second phase by a consolidation of the remaining or newly established S&T organisations, and the third phase by the integration of these individual parts into a new system.[131] In his opinion, the first two phases have been accomplished by now, while the third one is still under way. According to this model, the first phase in the post-soviet countries was characterised by the breakdown of top-down processes, and fragmentation of the S&TS, resulting in the survival of only selected elements in the form of either individuals or organisations. In the next phase, the organisational structure, in science, politics and industry, was modified, allocating other functions to former elements, and new functions to newly established elements.[132]

There are also some authors, e.g. Acha and Balazs, who are more inclined to speak of already existing NSIs undergoing transformation. These authors assert that an NSI can't be created from scratch. There must already be an NSI in place "developing both because of and in absence of

[130] Bitzer, J. (2000) An Evolutionary View of Post-socialist Restructuring: From Science and Technology Systems to Innovation Systems. In Hirschhausen, C. von, Bitzer, J. (eds.) (2000), op cit., p. 13.
[131] Meske, W. (2000) "Changes in the innovation system in economies in transition: basic patterns, sectoral and national particularities". *Science and Public Policy*, Vol. 27, No 4, pp. 253-164.

policy"[133]. However, by acknowledging the development processes within an NSI they do not treat it as an accomplished model. In this way, they are basically of the same opinion as other authors, with the only difference being the use of a specific term for a certain period.

Many of the authors reviewed above are of the same opinion that the main problem for establishing a coherent and well functioning NSI can be found in the inability to see enterprises as "the principal performers of R&D under market conditions"[134], "the main network organisers of innovation process"[135], and "new 'organisers' of innovation generation and diffusion"[136]. Generally, networking is seen as a problematic issue in the post-socialist countries, since under the socialist regime it was mainly constructed and managed on a formal level by the state authorities, and links between domestic users and producers as well as between foreign and domestic sellers were weak.[137] These weak links are seen as a heritage from the former system, with the persistent socialist model being 'embedded in these societies'[138], thus implying a strong path-dependency and inertia. According to Meske, lack of co-operation within the science system, as well as between it and other involved actors, including the government and industry, is the primary reason for not being able yet to accomplish the third phase of his model. Therefore, according to Johanna Chataway, the problem of linking organisations and activities undertaken in them through new networks of actors has become a focus of S&T policy, implying both dissolution of the old networks and formation of new ones.[139]

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[132] Ibid, p. 255-256.
[133] Acha, V., Balazs, K. (1999), op cit, p. 347.
[134] Ibid, p. 346.
[135] Radosevic, S. (1999), op cit, p. 303.
[136] Bitzer, J. (2000), op cit, p. 32.
[137] Radosevic, S. (1999), op cit, p. 291.
[138] Acha, V., Balazs, K. (1999), op cit, p. 346.

4.2 Triple Helix role formation

The roles of the actors involved in the innovation process are also being reconsidered and modified in the former soviet countries. Both their interrelations and their particular functions have been, and still are, undergoing certain changes and alterations. The new division of tasks in the innovation process has also led to the loss of functions for different actors of the former S&ST. There has been both a transition in the laws and regulations provided by a governmental infrastructure, and a transition within the organisations and their interrelations.[140]

While under socialism all relevant functions were taken over by the state, the introduction of capitalism as an economic principle was marked by a shift of many of these functions from the state to the private sector.[141] This shift has led to the reassessment of governmental roles, in relation to both the economy and other social institutions. According to Etzkowitz, there are indications that a more sophisticated view of the role of government as a catalytic force is emerging in the context of transition economies, thus implying that this transition is not to a pure market but rather towards a mixed system of market forces and government initiatives.[142] However, it must be noted that in regard to S&T issues this shift has been very gradual, since after the collapse of the USSR the newly established governments left S&T policy without proper attention. Initially, they were concerned with more urgent matters in social and economic policy like liberalisation, privatisation and crisis management.[143] There was also considerable cutback of R&D funding, since its potential role in the revival of the economy was not comprehended yet.

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[139] Chataway, J. (1999), op cit, p. 356.
[140] Etzkowitz, H. (2000) "Technology transfer and the East European transition". *Science and Public Policy*, Vol. 27, No 4, p. 231.
[141] Bitzer, J. (2000), op cit, p. 24.
[142] Etzkowitz, H. (2000), op cit, p. 234.
[143] Balazs, K. (1995) "Innovation Potential Embodied in Research Organisations in Central and Eastern Europe". *Social Studies of Science*, Vol. 25, No 4, pp. 655-683; Schimank, U. (1995) "Transformation of Research Systems in

The system change has also affected the research activities of the actors involved. Not only are many research activities no longer supported and guided by the state, but they have also undergone organisational change. Under socialism, these activities were organised into three distinct and sharply separated sectors, namely, academies, universities, and 'branch' sectors, based on the general principles of central planning, namely, specialisation, rationalisation and centralisation[144]. Then, after the collapse of this regime, this institutional separation was abolished. Under the formerly existing institutional framework, universities were primary training bodies[145], while basic research was carried out in the academies of science, with applied research and product development being the prime task of branch institutes and special design offices[146]. Production was also separated from the former activities and was solely undertaken by industry, which in turn had no relation to research. This was a rather artificial division, constructed on the basis of the linear perception of innovation process, and was accordingly transformed following the breakdown of the socialist system. However, lack of interaction between these units and their former fragmentation now forms one of the basic problems for establishing a well operating interactive innovation model. Though formally channelled contacts were unofficially supplemented by informal links, many of the latter were broken or vanished in the reform process.[147]

Central and Eastern Europe: A Coincidence of Opportunities and Trouble". *Social Studies of Science*, Vol. 25, No 4, pp. 633-653.

[144] Balazs, K., Faulkner, W., Schimank, U. (1995), op cit, p. 615.

[145] Ibid, p. 616; Schimank, U. (1995), op cit, p. 638.

[146] Bitzer, J. (2000), op cit, p. 16.

[147] Balazs, K., Faulkner, W., Schimank, U. (1995), op cit, p. 616; Balazs (1995), op cit, p. 668.

4.3 Developments in technology transfer

Since networking and linkage formation was rather weak in the soviet times, rather considerable efforts have had to be made in order to promote and establish them. This is not something that can be done overnight and it still faces various obstacles. To improve technology transfer activities, the following barriers have to be overcome:[148] (a) 'financial gap' between technology suppliers and users within manufacturing enterprises; (b) shortage of finance for spin-outs and start-ups, or for project development within existing companies and institutes; (c) lack of government funding and policy favouring technology as much as basic science; (d) lack of knowledge and experience of the technology transfer process; and (e) linear perception of technology transfer concept among policy makers. Other prerequisites for technology transfer facilitation include a stable political and legal environment "with reliable contracts replacing force as the guarantor of relationships".[149] Nevertheless, some analysts hold the view that lack of resources, which is mainly seen as a hindering factor, has in fact been "the most effective measure of a research policy aimed at intensifying technology transfer to industry", since those involved in research have had to look for ways to cope with the situation and for financial provision.[150]

4.4 Innovation support initiatives

Initially the R&D sector was abandoned not only by the government, but also by the market and industry, thus forcing R&D organisations to adopt either 'passive' or 'active adjustment strategies'.[151] In this context formation of IISOs in the form of science and technology parks and

[148] Chataway, J. (1999), op cit, p. 362-363.
[149] Landes (1972) as cited in Etzkowitz, H. (2000), op cit, p. 231.
[150] Schimank, U. (1995), op cit, p. 645.
[151] Balazs, K. (1995), op cit, p. 659-660.

centres, following a model adopted from the western countries was one option for researchers to make the transition from research to entrepreneurship, though it has been noted that in some cases these initiatives simply amounted to attempts by research institutes to rent out unused space[152]. These were previously non-existent bottom-up initiatives that were expected to improve communication and networking.

However, as noted by Acha and Balazs, they are not capable of correcting "the problems of focus, initiatives, structure" which are integral to the principal organisations of the evolving NSIs of CEECs.[153] Initial introductions of elements of this kind have been more like stand-alone initiatives, and not part of any coherent S&T policy.[154] As argued by Balazs, this was more a means for utilising idle capacity rather than for creating something essentially new, since the CEECs had as their primary role of job protection rather than job creation.[155] However, the role of these organisations should not be underestimated, since they have a rather vast potential for further development, depending on the success of local adjustments in determining their optimal operation modes.

5. THE CASE OF LATVIA

On the background of the preceding chapters we now turn to the examination of the Latvian case, starting with the outline of the innovation policy developments and framework in Latvia, and subsequently turning to the selected cases and their analysis.

[152] Chataway, J. (1999), op cit, p. 362.
[153] Acha, V., Balazs, K. (1999), op cit, p. 347.
[154] Balazs, K. (1995), op cit, p. 674.
[155] Ibid.

5.1 Innovation policy framework in Latvia

As in most post-socialist countries the innovation policy developments in Latvia are of a rather recent and fragmented nature with some coherence within it emerging only lately. Since 1991 several documents have been elaborated, reflecting gradually increasing attention to the role and concept of innovation and its support system.

The process of the commercialisation of science is said to be initiated in 1992 by the Ministry of Education and Science, with the "Concept of the Development of Technology Centres in Latvia".[156] These centres were intended as business support structures filling the gap between higher education organisations and industries, and promoting the development of SMEs through international economic and scientific co-operation for designing high quality products.[157] The Law of the Republic of Latvia "On Research Activity" was adopted by the parliament in 1992, with several amendments made in 1996 and 1998. In 1995, the Law "On Higher Educational Institutions" was adopted, aiming to integrate research institutes into the universities in order to modernise universities and strengthen their research capabilities. Recently, documents like the National Programme for Development of SMEs for 1997-2001 (1997), the "National Concept for Research Development" (1998), and the "Concept for Higher Education Development" (1998) were developed and adopted by the Cabinet of Ministers. With the aim to stimulate creation of new technology oriented SMEs and to involve more research laboratories and institutes in state industrial development, the "Concept for Innovation Activities" (1998) was also elaborated, but it

[156] Though this concept is mentioned in some sources, no such document can be found in any governmental reports or other materials.
[157] Ribickis, L. (2001) "Problems of Technology Transfer and RTD Activities in Latvia: Role of Universities, Research Institutes and Innovation Support Structures". Paper presented to conference "Baltic Dynamics 2001", Riga, Latvia, September 14-16.

was only reviewed and taken into consideration by the Cabinet of Ministers.[158] In the same year (1998) the Latvian Government accepted the "Concept for Creation of the National Innovation System" (NIS), with the main aim of promoting development of the national economy and the process of integrating Latvia into the European Union (EU). The year 1999 was marked by the adoption of the national programme "Informatics", while in 2000 the "Long-term Economic Strategy for Latvia", which sought to create a knowledge-based economy in Latvia, as well as the "Industrial Strategy for Latvia" were accepted. The most recent event in the field of innovation policy was the adoption in 2001 of the "National Concept for Innovation", which directly addresses issues of innovative development in Latvia, and also provides the basic definitions of relevant concepts.[159]

Thus, the NSI concept has reached the policy agenda of the Latvian government and is beginning to be comprehended and adapted to the local conditions. A largely external stimulus for this is the current goal of Latvia to reach EU development level, and in this respect innovation is slowly coming to be seen as one of the instruments for achieving this aim. Insufficient levels of all the components forming innovation system are being understood and acknowledged – including, among other things, the critically low financing for R&D, absence of research work involving industrial enterprises, poor technical equipment for research activities at universities, weak linkages between research labs and industry, insufficient technological education at universities, a legislative environment not sufficiently favourable for innovative activities, problems with attracting investment for research work for development of new products and services, etc.[160]

[158] http://www.innovation.lv/development.htm
[159] http://www.lem.gov.lv/En/nat_conc.stm

Given these conditions, certain activities are gradually being undertaken in order to improve the current situation, and one of these initiatives has been the introduction of IISO concepts and models to Latvia. As acknowledged by Silins *et al,* these are considered to be effective instruments for supporting innovations and new SME formation, due to lack of large-scale investments in transitional countries like Latvia.[161] The financing and loan system is still very rigid in regard to risk capital and new product development; therefore, state support is very essential. According to the position taken by the Ministry of Economy, "government has a crucial role in creating an environment favourable for innovative activities by performing rational restructuring of the economy and promoting development of technology-oriented entrepreneurship by utilising the resources within its control in an efficient way."[162]

The economic and political justification for the implementation of the above-mentioned technology centre development concept has been the current situation in S&T, characterised by the multifold decrease of students and people employed in technical sciences, low percentage of high tech goods in Latvian export and the small number of SMEs, if compared to other European countries.[163] At present, several (though still comparatively few) organisations of this kind have been established. They have organised themselves in the Latvian Association of Technological Parks, Centres and Business Incubators (LTICA) established in 1996.[164] Among its founders are also the two IISOs selected for this research, discussed in more depth in the following chapters.

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[160] Ibid.
[161] Silins, A., Stabulnieks, J., Viesturs, U., Ekmanis, J. (1998) "Some problems of innovation and technology transfer for countries in transition: the Latvian case". Lecture for the "World Innovation Forum", November 16-19, Paris.
[162] http://www.lem.gov.lv/En/nat_conc.stm
[163] Kondrats, G. (2002) "When science will lay golden eggs" (in Latvian). *Majas Viesis*, April 5, p. 8.; Feders, G. (2002) "Creative ideas promote welfare" (in Latvian). *Diena*, May 11, p. 10.

5.2 Case studies and analyses

In this chapter, introductions of the selected cases, as well as further analyses, are presented using homepage materials of LTC[165] and LTP[166], reports[167], and information gathered during the interviews with both the managers and tenant firm representatives of these two organisations, as well as related interviews and materials published in printed media. While sections 5.2.1 and 5.2.2 are of a more informative and factual character, section 5.2.3 is devoted to more profound data analyses, comparisons, interpretations, and conclusions. In order to make comparisons easier, the same progression has been chosen throughout the descriptive part of the two cases.

5.2.1 Latvian Technological Centre

5.2.1.1 Origins

The Latvian Technological Centre (LTC) was the first innovation centre initiative in Latvia, involving a form of business incubator that was established in 1993 in Riga, the capital of Latvia. By its legal status, LTC is non-profit limited liability (Ltd) company initiated and financed by public organisations – ministries and municipalities. This idea originally came from the Department of Higher Education, Science and Research within the Ministry of Education and Science, and was based on a Concept for the Development of Technology Centres in Latvia worked out by this department and based on the experience of developed countries. The founders of LTC were the Riga City Council, the Latvian Academy of Sciences (LAS), the Institute of Physical Energetics and the Association of Latvian Scientific and Technical Societies of Latvia. This centre was housed by the founding institute of the LAS, located in Riga and geographically

[164] Latvian Association of Technological Parks, Centres and Business Incubators (LTICA) http://www.innovation.lv/LTICA.htm
[165] Latvian Technological Centre, http://www.innovation.lv/ltc
[166] Latvian Technology Park, http://www.rtu.lv/WWW_LTP/LTP.HTM

surrounded by four other research institutes. Implementation of the concept was offered to different research institutes, but the Institute of Physical Energetics was the only one to take the risk.[168] LTC was intended as a 'test-bed' for the development of innovation and technology-oriented SMEs support organisations in Latvia. The financial base of LTC is drawn from the state budget, though it is being gradually reduced.

5.2.1.2 Aims

According to the aims set for and by this organisation, its main task is to promote and support the establishment of technologically oriented SMEs. LTC also aims to promote co-operation between higher education organisations' scientific units, on the one hand, and production, on the other; to create regular contacts between research laboratories and industry; to promote international collaboration of small enterprises with an aim to produce competitive, high quality, products; and to create new jobs for qualified specialists and scientists.

In line with LTC statements, its services are provided only to the innovative activities of those Latvian firms that have already a defined business idea and its implementation plan. A potential tenant firm's products, irrespective of its scientific-technical specialisation, have to be technologically oriented and with high added value. Besides the company has to be registered with the State Company Register. The potential tenant firm and its business plan are reviewed at the LTC board meeting, which is constituted by founders' representatives, and which gives the final decision of acceptance. At these board meetings, which are held every year, both potential

[167] LTC (2002) Report on LTC activities in 2001. 58 p.
[168] Kirtovskaja, M. (2001) "Incubator for an innovator" (in Russian). *Respublika*, April 17, p. 5.

and current tenant firm activities are examined and discussed in regard to their prospective or further operation within the centre.

5.2.1.3 Services and functions

For the realisation of its aims, LTC is expected to offer business incubator services, starting from well-equipped office and production facilities on preferential rent terms (on average 60% of actual cost, ranging from 30 to 100%), technological and administrative services (copying, printing, translation, telecommunications, incl. Internet etc.), specialised consultations and information for technologically oriented entrepreneurship, support for participation at specialised exhibitions, assistance in seeking co-operation partners as well as in marketing newly developed products and co-operation options, etc., and consultations on the possibilities of receiving credit or other kinds of financial support by taking part in international projects. LTC tenant firms also have access to more than 10 local and international newspapers and magazines and are provided common advertising in printed and other media. They are also offered assistance in creating their home pages on the Internet. The stated tenant firm incubation period is set for 5 years, after which full rent has to be paid while other services are still available. The total space of laboratory and office rooms is about 2,200 square meters, all of which is currently occupied by tenant firms. The basic LTC staff is formed by 7 people, including the managing director, two project managers, an office manager, and a chief accountant, all with their offices in the LTC premises building. Additional people are annually being engaged on a project basis.

5.2.1.4 Activities

In addition to these tasks, LTC participates in, co-ordinates, and promotes projects financed by the EU. Currently, LTC co-ordinates the EU project IRC (Innovation Relay Centre) LATVIA,

aiming to promote the development of SMEs and international co-operation in technology transfer. Apart from this project, LTC also co-ordinated the 5th Framework Programme project on organisation of an international conference on "Baltic Dynamics", an exhibition called "High-tech Baltics", and a parallel broker event that was held in September 2001 in Riga. In a partner status LTC also takes part in 4 other EU projects on the promotion of SME activities. Additionally, LTC is involved in a common project with the Finnish government called "Development of Finnish-Latvian business". LTC also houses a German Industrial research association bureau in the Baltic countries that is open to all enterprises and research institutes interested in co-operation with German partners in R&D.

Last, but not least, LTC also takes part in the development of state economic policy, mainly through the engagement of its director, Janis Stabulnieks. LTC representatives have been invited in to, and actively take part in, the development of state innovation policy and strategy. LTC is an active participant of several international associations, as well as being one of the founders in the LTICA.

5.2.1.5 Tenant firms

Currently, there are 25 local firms operating at LTC, including four associate ones[169], with a total of around 240 employees.[170] The main scientific-technical specialisations of the LTC firms are laboratory instrument production for medicine and biotechnology, electrical engineering and

[169] These are firms that have operated in LTC but in most cases have developed so far as to move to other larger premises, although they are still in contact with LTC.
[170] Since the last available LTC report is for year 2001 the following numbers will be accordingly based on data for this year.

telecommunications, computer engineering and polygraphy, new material technology and environmental protection, etc.

In 2001 the total number of 21 tenant firm employees was 233, while in 2000 there were 260 employees for 25 firms, and, in 1999, 258 employees for 31 firms. Out of the 233 employees in 2001, 20 held a scientific degree while 85 had an accomplished higher education. The average number of employees per firm was 11 compared to 10,4 in 2000 and 8,9 in 1999. Although during the last years the number of firms has decreased from 39 in 1998 to 21 in 2001, the average number of employees is constantly increasing. This is also true in regard to the net turnover, which has increased from 1,27 billion LVL[171] in 1997 to 4,17 billion LVL in 2001, despite the decrease in the number of firms. According to LTC report data, irrespective of the fact that many LTC tenant firms are still in their initial business incubation stage, the received state grant is being fully paid back through various taxes collected since the very beginning of LTC's establishment, with the returned sum in 2001 exceeding the received one 15,5 times.

5.2.2 Latvian Technology Park

5.2.2.1 Origins

Following the initiative of academic personnel (rector) of the Riga Technical University (RTU), the Latvian Technology Park (LTP) was founded in 1996 as a non-profit organisation. Other LTP founders were representatives from both the private and public spheres - University of Latvia (UA), Riga City Council, the Latvian Development Agency, the Latvian Privatisation Agency, the Chamber of Trade and Industry of Latvia, the European Development support fund in The Netherlands, the Latvenergo company, the "Riga Water" company, "Invest Riga" Ltd., and the

"Datorsalons ELVA" company. LTP is morally supported by the Ministry of Education and Science, the Ministry of Economy and the Ministry of Environment and Regional Development.

LTP is located in the former buildings (barracks) of the soviet army in Riga, on four hectares of land with a total building and construction space of 6,000 square meters. One of the main goals for LTP's establishment was to reorganise this available land and complex of buildings into a technologically developed area.[172] After the withdrawal of the soviet military forces following the collapse of the USSR, these buildings were left without supervision. This led to their deterioration before the premises were taken under the supervision of RTU and consequently handed over to LTP. No funding except for the limited initial capital of the founders and some orders from the Ministry of Education and Science for realisation of projects dealing with innovative activities has been allocated for the restoration of the buildings and for the adjustment of infrastructure. These tasks are still under way, using resources obtained during LTP's operation period. Financial support has been requested on both the governmental as well as the municipality level, though without any substantial results for the time being. However, certain hopes are still associated with Riga City Council, which is one of the LTP founders. Certain attempts have been made to attract foreign investors, though it is not expected that such investors would invest in LTP's development as such.

5.2.2.2 Aims

LTP aims to promote commercialisation of science through modern technologies, by developing and supporting small and medium-size production companies. These firms' innovations are

[171] 1 LVL=0,593 EUR=0,0642 SEK (15.07.2002)

expected to have originated in RTU, the UA or any other Latvian institution of scientific research, to be patented, secured by copyright, or otherwise protected, and to prove commercial viability after thorough market studies.

5.2.2.3 Services and functions

LTP plans to rent out low-rent premises for enterprises according to very different needs, starting from the small office of 15 m^2 up to a space appropriate for a small technologically oriented industrial enterprise of 500 m^2. Currently, 70% of the premises are occupied. A wide land area with convenient parking places and green zones has been placed at the disposal of LTP. The enterprises will be able to use separate heated and unheated warehouses. LTP will include premises for meetings, training and conferences with general-purpose furniture and specialised equipment. LTP plans to offer services starting from office and secretarial services and up to complicated technological and legal consultations rendered by the personnel of the LTP, or other involved or invited firms or persons, depending on the need and economic justification. LTP Business Innovation Centre (BIC) information service provides EU databases and literature, Latvian databases and business literature, ICECE, IASP databases and news, and international networks. The current basic services of the incubator are telecommunications, data communication, office services (copying, mailing service, secretary, office supply), refectory, and basic information service (basic business literature and newspapers). LTP in co-operation with the Swedish firm Reglertekniska Ingenjorsburan AB (RIB) and RTU, has established a Process Control Training Centre offering training courses in process control and industrial measurements.

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[172] Stabulnieks, J. (2001) "Converting a Research Institute to an Innovation Centre". In *Utilizing Technology Transfer to Develop Small and Medium Enterprises*. E. Bulumac and R.A. Bendis (eds.) ISO Press. p. 104.

The main criteria for selection of participants are expected to be the quality of the idea, market potential, technological and innovative level, competitiveness of the business idea, estimated position in the market, entrepreneurial ability, effect of technology transfer, risks, international level, time schedule, and 'fit' within the incubator. However, at the moment the basic selection principle is the production criterion, excluding solely trade-oriented firms, and the financial capability of a potential tenant firm to invest in refitting the necessary premises. In this respect, it is seen as a crediting case by LTP. Thus for a certain period of about 4-5 years, depending on the invested resources, the respective firm is allowed to operate there without paying any rent.

LTP basic staff consists of 7 people, including the chairman of the board, director, accountant, technical service manager, project manager, consultant, and territory administrator. All except for the last work in an office located within the premises of Riga Technical University. Apart from this staff, RTU specialists are being involved for consultations in specific fields. LTP is the member of several national and international associations and has close contacts with different local and foreign IISOs. It has also been involved in several EU projects.

5.2.2.4 Tenant firms

LTP firms represent various branches, including construction, education, energetics, engineering, environmental technologies, food industry, information technologies, light industry, logistics, mechanics, polygraphy, radionics, services, transport, and woodworking industry. Currently there are 44 listed tenant firms with 27 located in the park's territory and 17 outside it. The ones not located in LTP buildings mainly have weak or even almost no links with LTP and its management. Their relation to LTP is of a more formal nature, based on initial personal acquaintance with the first director of the park and fragmentary collaboration. In the opinion of

the current LTP director, these firms can hardly be considered park firms, since they have almost no financial or organisational relation to LTP. According to this division, the 27 tenant companies located within LTP premises are mostly service companies or related to food industry, logistics, building, etc, while the ones located outside LTP are mostly technologically oriented ones. Since the beginning of LTP's establishment, the tenant firm turnover has increased from around 35,000 LVL to 2 million, the number of tenant firm employees has reached 300, and 40,000 LVL are being paid in taxes.

5.2.3 Summary

As can be inferred from the above given factual information, both cases have certain similar as well as diverse characteristics in regard to both the available figures and qualitative data. In order to point out at least some key ones, a brief table of the presented facts is provided here as both a summary of the proceeding sections and an introduction to the following comparative and analytical chapter (*see Table 6*).

Table 6. *Basic comparative facts for LTC and LTP*

Support organisation	***Latvian Technological Centre***	***Latvian Technology Park***
Foundation year	1993	1996
Basic funding	State budget	Accumulated resources
Initiator	Government	Technical university
Territory	2,200 sq.m.	6,000 sq.m.
Location	Riga (capital); Outskirts	Riga (capital); Outskirts
Milieu	Near to 5 research institutes	Apart from universities and research institutes
No. of tenant firms/associates	20/5	27/17
No. of tenant firm employees	~230	~300
Management and administration	7 + projects	7 + projects

5.2.4 Comparison and data interpretation

Following this introductory information, the data obtained have been analysed within the chosen conceptual framework. Since the NSI perspective has already been rather extensively applied in regard to the post-soviet context, which is also the condition present in Latvia, subsequent sections concentrate more on application of the TH perspective and the practice of technology transfer within the context of these two IISO cases. The review and analyses of these two cases give way to a number of interesting observations on the level of these particular organisations, on the more general level of this kind of organisation in Latvia, and finally, again, in the context of post-soviet countries. In the following sub-sections these are presented mainly on the bases of the general and specific empirical research questions identified in sub-sections 1.4.1 and 1.4.2, with some additional themes being marked out and analysed as well.

5.2.4.1 Underlying intentions

The first implication arising from the situation of IISOs of this kind in Latvia relates to the basic goals for their establishment. While in other countries these organisations are said to be initiated in certain less favoured regions in order to improve their competitiveness, in Latvia it is more the case of creating them around certain potentials. At the moment, their development is concentrated in the capital of the country, since this is the most likely place to attract and generate innovative business ideas. This is largely due to the population structure of Latvia, where around 40 per cent of population live in Riga. In this sense, Riga is a typical metropolitan area, where most of the higher education as well as research organisations are located. These factors could thus be considered to be the decisive ones in the location of these organisations, which might later extend to other regions as well. Certain processes of deconcentration are taking place with the

emergence of new developing cities and regional higher education organisations, which are the prerequisites for the necessary milieu for this kind of development.

5.2.4.2 Triple Helix application

Another essential observation that can be made is related to the general role of the *government* in the creation and development of this kind of organisation. With the shift from planned to market economy, there has been an important change in the role of the government, with private initiative coming to the forefront instead of overarching public regulation. However, this does not imply total diminution of governmental involvement in the development of the country's economy. According to the official from the Ministry of Education and Science, "it is commonly thought that market conditions will set everything in order", but "it turns out that the market can't help in this, thus state action is required".[173] In the opinion of the LTC director, "the promotion, development and improvement of education, research activities and innovative entrepreneurship is a task of each country's government", hence "financial resources of the state have to be invested for the development and stabilisation of the NSI".[174]

The two cases studied present an excellent lesson on how governmental initiative and intervention is essential in influencing their operation. This is where the TH perspective is so valuable, since the lack of presence or underdevelopment of one element or the other - be it academia, government or industry - has a clear impact on the success or failure of development. It is not to say that lack of one or the other makes it impossible for IISOs to exist, but it definitely holds back the progressive development of this kind of organisation. In the cases discussed

[173] Tomsone, I. (1998) "Will innovations help the economy?" (in Latvian). *Neatkariga Rita Avize*, March 3, p. 3.
[174] Graudins, U. (2001) "Knowledge transformation into money" (in Latvian). *Lauku Avize*, February 15, p. 26.

above, it can be clearly seen how initial as well as continuous governmental support is essential, in terms of both finances and the general position with regard to the necessity and role of national innovation promotion initiatives. According to interviews, governmental structures also play a certain role on a local government level in providing contract work, etc., with tenant firms. This is another kind of mutually advantageous collaboration, though constituting rather small proportion, if compared to collaboration with private firms.

The state's role is seen as essential under the current conditions, where the credit, loan and risk capital system is underdeveloped, thus not promoting the establishment and development of new enterprises. In practice the required investments are not that large in order to support the initial take-off. Besides, in the case of LTP they are expected to be, and in the case of LTC they have already been, paid back in considerably larger amounts in taxes and in the overall contribution to the development of the economy. Thus, it is essential for the government to understand the principle of how these small innovative enterprises can repay the invested resources. This is seen as a problematic point, thus hindering the supply of finances from the state.[175] Thus, it is not only about financial but about ideological support as well, since, according to the LTP managing director, the respective policy documents are "the umbrella determining all operation principles". He also admits that there were many programmes made 5-6 years ago, but "if not professionally worked out they die very soon and no financial injections can change it". It is also an issue of governmental priorities. In Latvia, these are currently orientated towards privatisation and related issues, thus setting aside ones related to the creation and stabilisation of the NSI.

[175] Grinberga, H. (2000) "Where product and service meet" (in Latvian). *Latvijas Vestnesis*, October 5, p. 10.

At the same time the contribution of *academia* should also not be underestimated, since no governmental support can help if there is no pool for innovative business ideas to come from. In this sense, LTC has succeeded by being established on the basis of academic support and by locating itself in the midst of 5 research institutes that provide the necessary milieu. Actually, this is another essential contributing factor to the successful development of this initiative, since close geographical proximity and attachment to these research institutes implies closer links with research than there might be in the case of LTP. The latter is located more separately and attached to universities that might be considered to have a more educational orientation, compared with the applied research focus of the institutes. As argued previously, during the soviet period research was separated from universities and located within institutes, thus not being in line with the model characteristic of western countries. Latvia, like other post-soviet countries, is currently undergoing a transition to this western model, in which both research and education are integrated in universities.

It should be also noted that many companies were formed right after the collapse of the soviet regime, under pressing conditions when many existing research units were eliminated, destroyed, or on the verge of being closed down. According to the interviews, many people partly stayed in those institutes, research organisations or departments that still existed in one way or another, but at the same time were looking for other possibilities and options in coping with the critical situation and future prospects by undertaking private business initiatives. This is something that was also experienced by researchers in other similar countries, where after the socialist model's abolition many elements of the former S&TS strove to transform themselves into commercial

enterprises.[176] In many cases, this was more a matter of despair and survival than a well-considered alternative or preferred option as also established by Schimank[177] in regard to other post-soviet countries. This had to do with the withdrawal of financial resources from the state for the research institutes, as well as collapse of the whole industrial sector. A lot of work was being done for the military industrial complex of the USSR, which also collapsed together with this union. The people involved had accumulated intellectual potential during the soviet times, by being part of the large science effort of the USSR. Many organisations had to reorient from the large market of the USSR to the small domestic market. After the collapse, many scientists and researchers began to specialise in particular fields that they considered more favourable, under the current conditions, to base their business on. This was the first 'natural' impulse for entrepreneurship, which also marked a certain shift towards more applied research.[178]

The critical situation immediately after the collapse of the USSR left no space for any substantial resistance from academic organisations to the entrepreneurial initiatives of their staff members, since the financial situation of higher education and research organisations was rather critical. In many cases, those entrepreneurs who still continue some activities in academic organisations provide certain financial or human resource contributions, which would not be possible if they were inhibited from carrying on the business activities supplying their main income. This is again a common trait of all post-soviet countries, where many small firms have been started by university teachers and researchers with this 'half-hidden' arrangement providing the necessary income for operating the department, covering university overheads, and also allowing for some

[176] Hirschhausen, C. von (2000) Main Findings and Perspectives for Innovation policies in Eastern Europe and the West. In Hirschhausen, C. von, Bitzer, J. (eds.) (2000), op cit., p. 319.
[177] Schimank, U. (1995), op cit, p. 641.
[178] Grinberga, H. (2000), op cit.

personal income benefits.[179] Moreover, as in the case of LTP, the initiatives as such have come from the academic milieu. The LTC director has come from the academic milieu, as a researcher himself, and so have the first and the current director of LTP, who have both worked in RTU.

Finally, as to the third TH element constituted by *industry*, it has to be acknowledged that here the actual division between the three is starting to erode even more markedly. In the context of these cases, from a more systemic perspective, 'industry' might come to be interpreted as a sum or the outcome that is created when the two other elements, respectively, government and higher education and research organisations are joined through the mediation of a IISO. This does not imply that the two elements merge forming the third one – rather in their merger they create preconditions for another one, which are also essential for further development of all the TH elements. As stated by the former director of LTP currently taking the post of RTU vice-rector, there is no industry without science, just as there is no dynamic development of science without industry.[180] In his view "without developed industry no orders will be placed for Latvian scientists, university research laboratories will not be developed, and there will be no possibilities to prepare highly qualified engineers and new PhDs to become assistant professors and professors".[181] The shift to applied research through the establishment of new technology based companies means a merger between science and industry. On its own, science is expected to provide only an intermediate, rather than a final, product by supplying research and data output required by the industry to produce that product.[182] But this merger in many cases demands integration of both functions into one unit, where certain industrial experience is of high value

[179] Balazs (1995), op cit, p. 668-669.
[180] Grinberga, H. (1997) "In the time of explosive development" (in Latvian). *Latvijas Vestnesis*, December 5, p. 4.
[181] Ibid.
[182] Grinberga, H. (2000), op cit.

and together with scientific experience provides a solid ground for these business activities. However, not all founders of these new technology-based companies have these kinds of resources. Hence, they generally start off with the scientific element, and later gradually acquire the entrepreneurial skills required, at the same time also undergoing a change in their thinking.[183]

5.2.4.3 Technology transfer

If we speak of interactions between industry and university and technology transfer between them it has to be noted that understanding of the latter concept in Latvia is mainly linked or associated with transnational technology transfer, there being almost no reference to domestic one. This does not imply that the latter does not take place but rather it is not interpreted as belonging to this kind of process. Based on the interviews and analyses of the selected cases, the assumption is that technology transfer from higher education and research organisations (transfer agent) to technologically/scientifically oriented tenant firms (technology recipient) of LTC and LTP (transfer media) is a rather natural development in the sense that the main *transfer mechanism* is embodied in the know-how of the people from academic milieu, who largely form the bases of these knowledge-based companies. These companies are mainly created or operated by scientific and engineering technical employees in the role of idea generators, either starting or carrying on independent entrepreneurship by practically applying their knowledge and practice for production of knowledge-intensive products. Thus the main *transfer object* turns out to be embodied human capital and non-codified tacit human knowledge that is transferred in the form of spin-offs. Taking into consideration the different profile levels of LTC and LTP, it has to be admitted that this principle can be more generally applied to the LTC case, since the tenant firm selection criteria at the moment are higher and stricter as regards firms' innovative capacity. But this is

[183] Ibid.

also true in LTP case with regard to those firms that are of a more technological and scientific inclination.

Of course, there are also cases when the transfer mechanism is a spin-out (from a larger company) instead of a spin-off (from higher education or research organisation), but in the former the latter base is still present, since the firms spinning-out also have higher education and academic experience. Generally, there can hardly be any basis for an innovative company without adequate academic training. Accordingly I would argue in favour of the existence of *successive transfer mechanisms* where spin-offs/spin-outs as the initial mechanisms are followed by further ones, like continuing interaction or knowledge communication with former colleges, on both informal and contractual levels, or through simultaneous operation in both the former job at higher education or research organisations and in newly established private business. Other subsequent mechanisms would include participation in different conferences and exhibitions, publication, utilisation of laboratory services and expertise of other research organisations, and, finally, student attraction and employment. Another important mechanism at both early and late stages is collaboration with clients in the development of products – e.g., medical staff in pharmacy, farmers in agriculture, etc. These mechanisms can be regarded as the most common ones according to the interview data, while patent purchase, licensing and other transfer mechanisms are of minor importance.

It is commonplace that *students* or graduates are attracted to these firms in those cases where the leading personnel of the company does some tutoring at one or another higher education establishment where they are in direct contact and communication with these specialists-to-be. Thus, they have the opportunity to select the best students and involve them into their work.

According to the interviews, tutoring activities also force entrepreneur-academics to keep in pace with the times and new developments in their particular fields, since students are a demanding audience. At the same time, student-based firms are less common. According to the LTP former director Ribickis, "students work in LTP firms, but I can not say that student groups are queuing up for the creation of their own companies. In the last year of their studies, master and PhD students are already prepared to put their inventions and research to use, but they are hindered by the fact that no financial support for business establishment is available in Latvia - the lenders always ask for a property deposit. We still are not able to value the intellectual property".[184]

As to *patent and licence purchase* firms are not too active, since they have their own research and new developments that they work with. Neither are they very active in licensing out or selling their patents if they have any. The latter aspect has to do with the fact that many inventions are not being patented, due to high costs of the patenting procedure, patent maintenance, lack of expertise, and only local coverage of the patent in Latvia. Most of the tenant firms do not have resources for taking out a European or US patent, thus the main protection of their intellectual property is know-how and tacit knowledge. Often, firms admit that they have patentable products or processes, but they hesitate to process a patent for both the above-mentioned reasons, as well as due to uncertainty as to their demand and implementation prospects, which would be needed to justify the necessary investments. At the same time, the managing staff admits that the weak side for the firms is the underestimation of intellectual property and insufficient knowledge about

[184] Grinberga, H. (1997), op cit.

intellectual property rights and possibilities to protect them.[185] Some firms also raised this issue by pointing to the need for expert consultations.

5.2.4.4 Location preference

With respect to locational choice, there seems to be several underdeveloped services, in both LTC and LTP, but one has to take into account that IISOs in Latvia are comparatively new phenomena, with only a few in existence. Accordingly, there is also no scope yet for preference issues among tenant firms in regard to the selection of a particular location. At the moment, the basic principle is "take it or leave it", instead of a list of factors determining the choice of one location or another. This is true even though there might be a choice between LTC and LTP. In that instance, however, it can be argued that the two IISOs occupy different niches in this sphere. According to the LTP managing director, "we are not competitors, thus we help each other and we are delighted by each others' successes. We can't take away anything from each other". As to the choice between LTP and LTC, he admits that "any firm will choose a place with more attractive condition, accordingly to their perception, and there is nothing we can do about it. We can't offer better premises than we have. Neither can we reduce the fee since we won't be able to maintain the infrastructure".

Currently the sphere division between the two IISOs might be as follows: that LTC is more concentrated on small firms of a scientific nature, while LTP is oriented towards SMEs in general. LTP also offers larger premises, since at the moment LTC has almost exhausted its available space and mainly hosts firms that have been there from the beginning of its

[185] Ribickis, L. (2001) "Problems of Technology Transfer and RTD Activities in Latvia: Role of Universities, Research Institutes and Innovation Support Structures". Paper presented to conference "Baltic Dynamics 2001",

establishment. The operating firms are mostly not inclined to think about moving to other premises, except if they are expanding to an extent where they can open up their own production sites. Firms have strong roots where they are now located as well as developed and adapted infrastructure, and are not in a hurry to move away, even after the expiry of the initial support period. Of course, not all tenant firms manage to develop successfully. Just as in off park environments, there are firms that perish and are liquidated, though the success rate in TC/Ps is higher. There are also firms that leave LTC due to various reasons that either continue to operate on their own or are liquidated after some time of operation outside the centre. Some firms move to other premises due to expansion or attraction of stable investors or co-operation partners. The firm rotation in LTP is estimated around 20% per year with 6-7 firms leaving and coming in.

5.2.4.5 Contributing factors

When comparing different IISOs, the operation time factor should also be taken into consideration, since it takes some time for them to initiate their operation and present their first results. In our cases, this factor is also of importance, since there is a 3-year lag between the establishment of LTC and LTP. Besides, the infrastructural factor has to be taken into account as well. Alongside the unfavourable financial bases compared to LTC, LTP was also in an inferior position as to infrastructural conditions – a condition, which has also contributed to their slower and more burdensome development. As admitted by LTP former director Ribickis, "of course, new and rational LTP infrastructure with modern buildings is an important factor for firm attraction".[186] This leads to the perspective that there are certain steps that have to be passed in the progress of IISOs. The basic prerequisite for this kind of organisation is inevitably the

Riga, Latvia, September 14-16.
[186] Grinberga, H. (1997), op cit.

infrastructure, based on which one can further develop essential, services, etc. If one successfully tackles infrastructure creation, readjustment or arrangement, then one can move to the next step with extra service provision. The latter might have been initiated already in the first step, but without enough time or financial resources.

As can be inferred from the two cases, there are various ways to tackle with the first step. For LTC, the infrastructural factor was not such a burden, as it has turned out to be for LTP, since they had premises that had not been abandoned and were in much better condition, plus they had the necessary funding from the state budget to implement the basic reconstruction works, etc. Thus, making the first step was easier and not so time consuming as in the case of LTP, which has had to find other solutions to more acute infrastructural problems. Their problem solving strategy involves the postponement of introducing intended firm selection criteria, in favour of making the first step. On the other hand, LTC is now starting to face problems with lack of premises for prospective new firms. Moreover, it can't offer production premises, thus making firms geographically split their operations, which might become a certain drawback. This is why LTC is starting to consider some expansion options within a new science park project that is currently being actualised on a policy level. This would also involve expansion of the services now available to the tenant firms.

5.2.4.6 Management

As noted in the first part of the thesis, the attention in science park research has recently turned to their management structures, which are seen as highly important for their successful operation. Regarding this research, it could be argued that this factor has also been influential in these cases. The first aspect is the stability of the management team. In this regard, there are two observations

that have to be taken into consideration when dealing with these two cases. The first one is the fact that the managing director of LTC has been the same from its establishment and up till now, while in LTC there have been three of them in the course of its operation. To speculate, this might be one factor contributing to their different development routes, since more stable management also provides certain stability to the operation mode of the organisation. Besides, the leading people are expected to be progressive in their thinking and they have to be the so-called "science managers". At the same time, one single managing director can't guarantee the whole success or failure. It is, after all, a matter of teamwork, since a lot of work is done by other people from the park or centre management.

Ideally, the managing director should be the one co-ordinating the whole enterprise on a more general level, with project managers dealing with specific issues and working more closely in relation to the tenant firms. In the case of LTC, this turns out to be a problem, as perceived by tenant firms, since lately comparatively limited interaction has been taking place between the management and firms. As noted by the president of one of the interviewed LTC tenant firms, a certain shift in LTC's operation occurred with a change of managing staff and the death of one particular employee. In her opinion, the new employees conduct their jobs rather formally, without personal involvement and initiative, and are more involved in different European projects than in work with individual tenant firms, whereas previously the firms were being invited to different events and received frequent telephone calls from the management. The basic problem is perceived as the lack of a co-ordinator who would be constantly present and available, a "live" person. Certain similarities can also be seen from the interviews with LTP tenant firms, where personal involvement, attention and initiative of the leading managers is seen as crucial in

keeping mutual contacts between the firm and the management. Thus, the human factor seems to play a crucial role in the intensity and quality of interactions within the park or centre.

Further, tenant firms tend to be rather resistant to addressing the management (with some exceptions regarding the accountant at LTC) with their problems and assistance requests, trying to cope on their own. Sometimes, they are too passive in finding out the possibilities within the park or centre. This behaviour can, of course, be interpreted either as a lack of information or as a lack of initiative on the one side or the other. In many cases, the problem turns out to be the general nature of the available services or information, which does not meet the particular and specific needs and interests of a company. They would expect the management to have a deeper understanding of particular needs and problems of the firm, both in the initial point of starting off their business by evaluating their business plan more profoundly and during later periods of operation. In this respect it is also admitted that, e.g., LTC, carries out a more resumptive function that is directed more to the operation of the centre as such in regard to establishing common contacts and finding financial resources for its continuing operation than to the support of individual firms. Thus, more training, individual management, and marketing support is hoped for. Even if some training is provided, it is usually for those at an advanced level, without providing the basics for those not familiar with the relevant issues. At the same time the services that are provided and firms have used - e.g., support for participation at exhibitions, external advertising, and seminars - seem in many cases to be either taken for granted or not considered to be of essential assistance, since frequently they don't bring the expected results.

One more thing that has to be added in regard to management factors concerns the personal involvement of the LTC managing director in policy developments in this sphere. This

engagement opens extra space for indirect advertising and prestige of the represented organisations. During the operation time of LTC, he has been defending science-based enterprises and has continuously explained the role and nature of innovations, thus gaining respect from scientifically oriented entrepreneurs and making his views heard by officials.[187] In turn, this has also led to recognition on an international level, which demonstrates itself in the involvement of LTC in different EU projects that are not directly linked to LTC tenant firms and its incubation function, but provide additional advantages to this organisation. This is also a certain survival strategy for LTC, with additional formal, informal, and financial resources that come with such involvements. In this regard, LTC is positively considered to be more aggressive in its activities, which might be another factor in LTC's comparatively successful development. But this aspect has also to do with the above discussed operation time factor, since, according to LTP director Stabulnieks, his main function during the initial 3-4 years was advice provision and firm encouragement, while now the situation has changed, with firms having accumulated experience and LTC functions having expanded considerably. The latter is due to wider international involvement in these developments, through participation in different associations and conferences, thus expanding LTC's contact and action area. At the same time, no less importance has to be given to the reverse advertising where the name and the quality of a tenant firm provides prestige and additional advertising for the support organisation.

5.2.4.7 Tenant firm co-operation

Internal co-operation between tenant firms is not homogeneous, since for some firms it depends more on common business interests and not that much on opinion exchange or informal contacts,

[187] Lapina, A. (2000) "Advocate of science-based companies Janis Stabulnieks" (in Latvian). *Dienas Bizness*, May 30.

while for others the informal communication predominates. Some of the firms even admitted that they are not aware of the number and profile of all the tenant companies, and that basically this interaction depends on personal initiative. In the case of LTC, it was noted that there are several common events for all tenant firms, like New Year's Eve celebration, or common participation in conferences and exhibitions. However, it seems that more frequent gatherings would promote closer internal contacts.

According to location observations, mutual interaction is also not facilitated by the spatial dislocation of the premises. In LTP, first of all, there is no interaction between firms located in and out of the park. Secondly, the firms in LTP are located in several buildings, which also limits their everyday contacts. The same is partly true in regard to LTC, as well, since firm offices and laboratories are located in long and darkish corridors on different floors of the building. There is also no common room where firms can interact in an informal atmosphere. However, it is admitted that existing contacts are more active than they would be if the firms were not located in the same building. The close location is also considered to be a factor of convenience in case of certain consultation or purchase issues. The LTC director holds the view that the common location has a psychological effect, since "every tenant firm is a discrete juridical person independently solving its problems, but they work at a small distance, communicate, enrich themselves with new ideas" and thus don't feel as strangers, which is of high importance.[188]

5.2.4.8 International co-operation

There is a certain degree of co-operation with foreign firms, either in raw material purchase or in common projects. Mainly, existence or non-existence of these contacts is also determined by the

product specificity – that is, whether it is developed purely for the local market or has wider application possibilities. In the case of LTC, the management is aware that the main problem for the tenants is "not to create or introduce a new product or technology, but to manage the company and to find market niches and co-operation partners in foreign countries", with managerial and international networking skills needing to be improved.[189]

Expanding to foreign markets is often seen as an additional burden for a firm, since that involves a lot of organisational and managerial capabilities and overcoming the different local requirements and bureaucratic procedures of a particular country. Besides, it requires substantial financial base that is often not developed or achieved yet. There is also disbelief in successful prospects of competing with local products that are likely to be given preference by local customers. There are more collaborative bonds with the former USSR or soviet block countries, due to a more common situation and already established contacts in the soviet period. Another holdback in more rapid penetration in foreign markets is related to the processing of different certificates, accreditation and meeting the set standards either on local or European level, which again involves considerable financial investments. However, despite all these hindering factors, about 1/3 of LTC firms have found co-operation partners in Europe and the number of export countries of tenant firms is also growing.

5.2.4.9 Role of innovation support organisations

Finally an issue might rise about the necessity and optimal number of IISOs in Latvia. In this regard, rather different views were expressed. Some admitted that joining LTC helped the firm to

[188] Ozols, J. (2001) "Does Latvia belong to the new economy?" (in Latvian). *Biznesa Partneri*, April, p. 20.
[189] Stabulnieks, J. (2001), op cit, p. 103.

survive, while several respondents both from LTP and LTC considered that they would also have pulled through and developed without this support - of course, at the same time not denying the benefits they've had from location in a park or centre. They tend to argue in favour of bottom-up instead of top-down initiatives with firms making their own way and being capable of surviving on their own. Most of the respondents also argued that they don't see their presence in LTC or LTP as an additional argument or prestige factor in dealing with their business partners. The former aspect, however, might be partly explained by the fact that this view was voiced by one LTP firm not located in its territory and not utilising any services provided by the park, and by LTC firms that were already in operation before joining the centre. Secondly, this might simply be explained by human self-esteem, i.e., not admitting one's inability to deal with certain situations.

As to the necessity of more organisations of this kind, one LTP tenant firm director held the view that the capacity would decrease with every new park or centre, since their creation doesn't automatically generate more professionals. In several interviews, the view was voiced that actually there are not so many active scientists. Many developed inventions are still from soviet times. This issue is also closely related to the fact that the average age of scientists is critically high, with no new potential replacements joining the academy, due to the bad financial situation in science. At the same time, according to the estimations of Leonids Ribickis, there are on average 2-3 people per month coming to LTP with their ideas.

5.2.4.10 Words and deeds

The final, resumptive, research question of this work and altogether one of the most essential ones, concerns the 'words and deeds' of the selected IISOs, as regards their declared aims and

services and their actual implementation and provision. As can be partly inferred already from the preceding analyses, it has to be admitted that neither of the two IISOs adheres fully to its postulates.

According to the information provided in sections 5.1.2 and 5.1.3 on LTC, the following reference points can be distinguished for a consistency test. As to their aim to promote and support the establishment of technologically oriented SMEs, it is partly fulfilled– it is consistent in regard to the size of tenant firms (SMEs) and their technological orientation, but many firms are not newly established when joining LTC but are rather ones that have already operated for a couple of years. An explanation for this can be sought for in the fact that LTC was established only in 1993, while 'surviving' academic firms were formed right after the collapse of USSR in 1990-1991 and moved to LTC as soon as this option became available. Thus, LTC is providing more support for development, rather than establishment, of this kind of firm. Furthermore, this tendency is also supported by the firm selection criteria, which includes the status of a registered firm with a developed business plan, instead of assisting potential firms to be formed. Apart from this, other selection criteria seem to be fully in line with the postulated ones. As to LTC's service provision, this is also more or less in line with the postulated services, though one could discuss the quality of some services offered – i.e., their scope, efficiency and utilisation by the tenant firms. Speaking of some other aims, promotion of co-operation between firms and higher education organisations, and scientific units on the one side and production on the other might be questioned, since no production sites are allocated or assisted with for tenant firms, and hardly any concrete assistance is given in individual partner search on behalf of LTC. As to the promotion of international collaboration, some efforts are being made, though they are not always

followed by practical results, which again puts into question the focus to be taken, either on the initiative per se or its efficiency in determining (in)consistency.

The situation with LTP is slightly different. Based on their aims and service provision statements summarised in sections 5.2.2 and 5.2.3, it can be concluded that their actual implementation is substantially further removed from the aspirations than that established in LTC. For LTP, these statements are currently more of a potential and expected character than of a realistic 'state-of-the-art' nature. These statements should be considered as the condition that is striven for, a sort of ideal type that it will be attempted to realise with earlier or later results, depending on the pace of development and the level of support received. This inconsistency can be clearly seen in the firm selection criteria currently dictated by the developmental conditions of LTP already discussed above, with one exception as to the tenant firm size with predominating SMEs. This is also true of LTP's aim to promote commercialisation of science through modern technologies, which is not yet possible for the same reasons. Some efforts are being made to secure consistency in regard to service provision, though still a lot of services are still unavailable to tenant firms.

5.2.4.11 Summary

In summary, it can be concluded that development of IISOs in Latvia is still in an early stage with only some first attempts being made, thus determining rather specific conditions for the analysis of these cases. Transition from the planned to the market economy required a substantial change in the mentality of the involved actors, and a shift in the organisational set-up towards a more dynamic one. There is not much direct experience to be learnt from, which implies a 'trial' mode on the part of these first initiatives. Their success is largely dependent on the support received for their implementation. As can be seen from the both cases, support on behalf of the government is

essential under conditions where private initiative in this field is not yet well developed. Besides, in the case of Latvia these organisations are primarily needed in order to restore the former potential and keep it from perishing, rather than promoting the development of new firms, etc., which is only lately being actualised. Available funding, infrastructure, the range of offered services, management capacity, and operation time are of rather decisive importance for a stronger or weaker development of the IISO cases analysed here. However, these factors do not yet constitute the bases for preference on behalf of the tenant firms, since the choice options are not so many yet, and do not allow firms to pose strict requirements as to a preferential site and conditions. Nevertheless, there is still a lot of space for potential improvements in the operation of these IISOs, depending, of course, on their position with regard to the degree of intervention into the activities of their tenant firms and the willingness of these firms to be taught, guided and assisted. For the time being, there exists a smaller or more profound discrepancy between the postulated and actual operation principles of LTC and LTP.

6. CONCLUSION AND SUGGESTIONS FOR FURTHER RESEARCH

Both the contents of theoretical approaches and concepts applied in this research and their relation to the empirical study have given way to a number of focused reflections on both theoretical and empirical levels. From the theory aspect, it can be concluded, that in analysing the IISOs, the SI and TH approaches are complementary rather than mutually exclusive, though there are certain differences in their scope, focus and the underlying assumptions. With their divergent perspective levels, where SI takes a macro view and TH is primarily concentrated on a meso level, these approaches cover different aspects of the same phenomenon, thus adding to its more profound insight. The same is true as to their respective demand and supply side actor examination, providing us with puzzle pieces that put together make a more clear outlook.

It must be acknowledged, that the selected theories and concepts have turned out to be useful both for structuring this research and also for their application in the empirical examination, although a challenge was posed in applying them to the comparatively specific context of a post-soviet country. Nevertheless, all of these approaches and concepts have been, to a larger or smaller extent, useful analytical tools for investigating the specific processes involved in a gradual shift in the direction of innovative development. They have served as 'ideal types' for examining the specific characteristics of the particular cases. Though one could hardly argue in favour of a highly developed NSI in the CEECs, systems approach has provided ground for highlighting the substantial differences between socialist S&TS and the systems formed in the western world. The NSI perspective has turned out to be particularly important in understanding the extent to which historical and socio-economic context matters. The former and existing competencies, the organisational and infrastructural set-up inherited from the soviet period, and the newly emerging incentives provide a specific background and conditions for the formation and evolution of an NSI and Triple Helix roles in Latvia. These developments point to these concepts as unfixed entities allowing of changes, modifications and transformations.

As to IISOs, the possibility and adequacy of comparisons between developed and transitional countries on equal terms is somewhat limited for the time being, due to different paces and stages of development. In this respect, IISO mutual comparison within the same socio-economic and historical context is initially more adequate for comparative purposes, in order to examine more closely their operation principles and efficiency. Nevertheless, this does not imply that theoretical models elaborated in developed countries could not be applied to such research, as is also the case with the 'word & deed' method, or the so-called 'popular conceptualisation', which also turned out to be a useful tool.

The methodology chosen for this research was intended to reveal as much as possible about the issue under study, given the time, space, and funding restrictions. Nevertheless, it has to be admitted that this is not the only approach eligible for this kind of study, as already indicated by the decision to change methods during the preparation stage for data collection. For further research it could be suggested that, based on the qualitative data gathered for this research, a more elaborate and better-adapted questionnaire survey of the whole TP/C population could be carried out. This would help to capture some quantitative trends either supporting or denying the results arrived at by this qualitative study and to achieve even wider generalisability. Finally, though it was not possible to accomplish within this study, it might be useful and illuminating to have a control group of firms not located in, or directly related to, any IISO, in order to see whether there are any significant differences between these two groups depending on their location and affiliation. It would be interesting to investigate also other existent and emerging IISO cases, including regional IISO initiatives, in Latvia and to compare with the examined ones. Besides it would be worthwhile to study the topic of this thesis more profoundly from the university point of view as to existing or non-existing initiatives in the commercialisation of their research results that would touch the widely discussed issues of the value systems and inner order within these organisations in promoting entrepreneurial activities.

Issues analysed, raised or currently only slightly touched in this research are of prime importance in striving for the establishment of knowledge-based economy, continuously asking for an ever-increasing comprehension of the underlying dynamics. There is place for both an improved governmental awareness of the need for its promotional activities at least in the initial take-off stages for the local as well as other contributing actors, and a continuous academic devotion to developing this field of study further on.

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APPENDICES

APPENDIX 1: Basic interview questions for tenant firms

⇒ When and under what circumstances was your company established?

⇒ What is the origin of your company and its founders?

⇒ When did you become an LTP/LTC tenant firm?

⇒ How did you get to know about this organisation?

⇒ Did you examine any alternative locations except for the LTP/LTC?

⇒ What were the main reasons for your company's decision to locate in LTP/LTC?

⇒ What demands/criteria had to be met in order to become a tenant firm?

⇒ How many people started the company?

⇒ What is the current number of your company's employees?

⇒ What is the average age of your employees?

⇒ What educational background do your employees have?

⇒ What is the main field of your company's business activity?

⇒ Does your company carry out any in-house R&D activities?

⇒ Do you have any kind of production? Where is it carried out?

⇒ Do you have/have you purchased any patents/licences/certificates?

⇒ What are the main services provided by LTP/LTC?

⇒ What kind of assistance has been provided to you/have you used?

⇒ How satisfied are you with the offered services?

⇒ How often do you address the management about your problems?

⇒ What is lacking in service provision?

⇒ Have you made any suggestions for the improvement of existing and necessary services?

⇒ How important has been/is the role of LTP/LTC in your company's development?

⇒ Have you thought about changing your current location?

⇒ What kind of contacts do you have with other tenant firms?

⇒ Does your company have any links with higher education and research organisations?

⇒ What are the main co-operation mechanisms with these organisations?

⇒ What are the main problems in your company's development?

APPENDIX 2: Basic interview questions for LTC/LTP managers

⇒ Whose idea was the establishment of this organisation?

⇒ What example was followed in establishing this organisation?

⇒ Who supported the realisation of this project? Who provides the basic funding?

⇒ How was the physical place (location) chosen for the organisation?

⇒ What are the main activities undertaken by your organisation?

⇒ What were the main initial problems?

⇒ How large is the administrative and managerial staff of your organisation?

⇒ How important is the management role in this organisation?

⇒ What kind of assistance is offered to firms?

⇒ Are firms allocated production space?

⇒ How do you attract potential tenant companies?

⇒ How large is the demand from potential tenant firms?

⇒ What are tenant firm selection criteria?

⇒ What if there is a lack of firms meeting these criteria?

⇒ Are the tenant firms mainly already established ones or new start-ups?

⇒ What is the average size of tenant firms in your organisation?

⇒ How rapidly are new jobs being created within tenant firms?

⇒ What are performance criteria for being a good (successful) or bad tenant firm?

⇒ When are firms expected to show certain results?

⇒ What are the control mechanisms?

⇒ How long are firms allowed to stay in the park?

⇒ What is the entrance/exit dynamics of tenant firms?

⇒ When and why do tenant firms move out?

⇒ Is the main co-operation with external partners promoted locally or internationally?

⇒ What is your co-operation with the local higher education and research organisations?

⇒ What is your relationship with other science parks in Riga/Latvia?

⇒ What are the current main problems?

⇒ What are the main achievements?

⇒ What are the future prospects of your organisation?

APPENDIX 3: Interview list

No.	*Date*	*Respondent*
1.	May 21, 2002	LTP firm No. 1
2.	May 31, 2002	LTC project manager
3.	June 3, 2002	LTP firm No. 2
4.	June 7, 2002	LTC firm No. 1
5.	July 11, 2002	LTP managing director
6.	July 17, 2002	LTC tenant firm No. 2
7.	July 17, 2002	LTC tenant firm No. 3
8.	July 24, 2002	LTP tenant firm No. 3